Knowledge Organization, Concepts, Signs

A Semeiotic Framework

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Publication date:
2010

Document version
Early version, also known as pre-print

Citation for published version (APA):
Thellefsen, M. (2010). *Knowledge Organization, Concepts, Signs: A Semeiotic Framework*.

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PhD thesis from the Royal School of Library and Information Science, Denmark

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CIP – Cataloguing in Publication

Thellefsen, Martin

Knowledge Organization, Concepts, Signs : A Semeiotic Framework. – Royal School of Library and Information Science, Aalborg, 2010. xi, 193 p.

http://pure.db.dk/da/publications/knowledge-organization-concepts-signs_cacbe198-b26c-4987-abcc-e33a0a8ed910.html

ISBN 978-87-7415-322-1

Vidensorganisation, begreber, tegn

Et semiotisk perspektiv

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Ph.d.-afhandling fra IVA, Aalborg

Acknowledgments

The present dissertation concludes the work that took its beginning in August 2002. It has been a long and at times frustrating journey, due to different kinds of setbacks especially caused by detours into the depths of different theories.
I would like to express my gratitude to the people who believed in me and my work, especially my wife, Henriette, and two daughters, Emilie and Frederikke, who at times have tolerated a stressed up and distracted husband and father.
Other persons, that deserves my gratitude is my supervisors, mag. art. Anders Ørom, and Professor Birger Hjørland, whose comments and critique at different stages in the research process have been invaluable.
I would also in particular express my gratitude to my brother, dr. merc. Torkild Thellefsen, and my good friend cand. mag. Bent Sørensen, who has supported and encouraged me in my Peirce studies, Professor Søren Brier, whose work in cybersemiotics has been a great source of inspiration, and dr. Alon Friedman who I have worked with during the last two years, combining concept theory and semiotics in knowledge organization. Finally, I would like to express my gratitude to the Royal School of Library and Information science, for supporting my project; in particular, I would like to thank Professor Pia Borlund for her encouraging attitude, Brian Kirkegaard Lunn, for many inspiring discussions, also thanks to Jack Andersen, Henning Grauballe, Jan Graulund, Jesper Schnieder and Bo Gerner Nielsen for being good supportive colleagues, and thus making the Royal School of Library and Information Science a pleasant and inspiring workplace.
Thanks to NORSLIS for supporting travel expenses for courses and conferences.

Martin Thellefsen
Oktober 2010

Abstract

The purpose of this dissertation is to explore into the relations between semantic theory, concept theory and Peirce's semeiotic in relation to knowledge organization.

The dissertation enquires into the character and scope of representation demonstrated by different kinds of knowledge organization systems, how theories of concepts are approached, and how cognitive semantics and semeiotic perspectives may offer a more elaborate understanding of concepts and provide for an alternative analytical framework for knowledge organization.

The findings of the dissertation arrive at the conclusion that semeiotic theory may provide for a more elaborate and dynamical understanding of concepts, and supplement traditional approaches to knowledge organization with deeper insights into the nature of concepts, knowledge and communication.

Resumé

Formålet med denne afhandling er at undersøge forholdet mellem semantik, begrebsteori og pragmatisk semiotik i relation til vidensorganisation.

Afhandlingen undersøger karakteren og omfanget af vidensrepræsentation, som den fremgår af forskellige former for videnorganisationsystemer. Dvs. hvordan teorier om begreber bliver anvendt, og hvordan kognitiv semantik og semiotik kan tilbyde en mere detaljeret forståelse af begreber og dermed bidrage med en alternativ analytisk ramme for vidensorganisation.

Resultaterne af afhandlingen er, at semiotik kan bidrage til en mere omfattende og dynamisk forståelse af begreber og supplere de traditionelle tilgange til vidensorganisation med en dybere indsigt i forhold til begreber, viden og kommunikation.

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List of acronyms

CP: Collected papers: The collected papers of C.S. Peirce (Peirce, 1958-1966)

DA: Domain analysis

EP: Essential Peirce: Selected philosophical writings (Peirce, 1992)

KO: Knowledge organization

KOS: Knowledge organization systems

KOP: Knowledge organization processes

KR: Knowledge representation - discipline related to computer linguistics

LIS: Library and Information Science

MS: Manuscripts: unpublished manuscripts of C.S. Peirce

PI: Philosophy of information

SS: Semiotics and significs: The Correspondence between C.S. Peirce and V. Welby (Peirce, 1977)

1 Introduction

What is a representation and how does it motivate a particular meaning? This is the fundamental question that drives this dissertation. The question is intricate and should be essential for knowledge organization (KO)[1]. It should be essential because KO is concerned with theories and methods for organization and representation of information sources[2] in information systems. It is intricate because what constitutes a representation, its meaning and truth value depends on epistemic assumptions. And different assumptions about representations lead to different understandings of information systems.

Traditionally, knowledge organization systems (KOS) represent subject categories, their hierarchical structure, and different kinds of relationships. Subjects are in the context of KO thought of as conceptual, and as such a KOS in principal expresses an organization of concepts and categories that are useful labels for information sources.

KO is considered a fundamental part of Library and Information Science (LIS), and KO is concerned with theories about systems and processes connected to subject representation and retrieval of information sources.

KO can also be distinguished into a broader and narrower perspective (Hjørland, 2008). The narrower perspective is concerned with the applied nature of KO. The broader perspective addresses the context and theoretical foundation of KO. According to Hjørland (2003) the broader concept of KO includes 'the social division of society', 'social institutions', 'languages and symbolic systems', 'conceptual systems' and concept theories', 'literatures and genres'. Additionally, KO relates to other LIS areas as information retrieval (IR) and information seeking[3] that fundamentally depends on the quality of KOS.

In particular the narrow perspective in KO has been given much attention. Popular textbooks within the scholarly community are mainly concerned with KO in the narrow sense cf. (Hagler, 1997; Lancaster, 2003; Rowley & Hartley, 2008; Tayler, 1999). The wider perspective on KO has however gained increased interest among LIS scholars.

1.1 The context of knowledge organization: some philosophical aspects of information science

The philosophical aspects of information science appear to be of increasing interest among LIS scholars. This development is indicated e.g. by the special issue of Library Trends (winter 2004, 52(3)) which is dedicated to the philosophy of information (PI). Similarly, a special issue of Journal of Documentation (2005, vol. 61(1)) is dedicated to LIS and the philosophy of science. Though, as pointed out by (Buckland, 2005), a glance at the substance of the different contributions in the mentioned issues reveals that the philosophical perspectives proposed and discussed by the contributors are very different in nature and even incompatible. This may lead to the impression that LIS is struggling with its philosophical foundation or that LIS as science is immature.

I believe LIS lacks a unifying theoretical framework, that address the communicative functions of KOS, and it may arguably be explained as a consequence of the applied character of LIS and its sub-disciplines[4]. The success of KOS is for that reason mainly considered from the perspective of problem solving of, i.e. the particular problems that relate to the activities of cataloguing, indexing and retrieving documents and less on theories based in concept theory and philosophy. Many librarians may even say that philosophy is fascinating, but too remotely connected with the particular work tasks and processes that take place in the everyday library life.

Speaking from the perspective of libraries, naturally the focus is on the life cycle of the library functions. Meta-theoretical reflections may be appropriate; however reflections on epistemology and paradigms may seem a bit excessive when dealing with daily library tasks.

I consider KO and the applied nature of KOS as key research areas within the field of LIS; however, the continuous theoretical reflection and problematization of praxis is important, and the only way to insure future developments of new and better information systems.

Organizing concepts is no simple task. In principle it involves reflections on how concepts are understood (e.g. intended vs. perceived meaning), represented (lexicalized), internally organized (intensional defined), externally related to other

concepts and structurally coupled to individuals, to culture/society, and to the surrounding world.

Concepts are dynamical, and exist in a continuum. The meaning of concepts is thus closely related to a universe of discourse, and affected by new discoveries; and what is considered knowledge now may be altered or modified by future investigations. As a consequence, a theoretical approach to KO that provides for a deeper understanding of concepts, how concepts develops and matures, how they relate to other concepts, and how they are used in communication within a community, is required. In other words, we need a theoretical approach that transcends the formal descriptive methods and prescriptive focus of objectivist lexical semantics and information architecture, without giving in to subjective relativism. In order to do so, at least four dimensions of understanding are necessary.

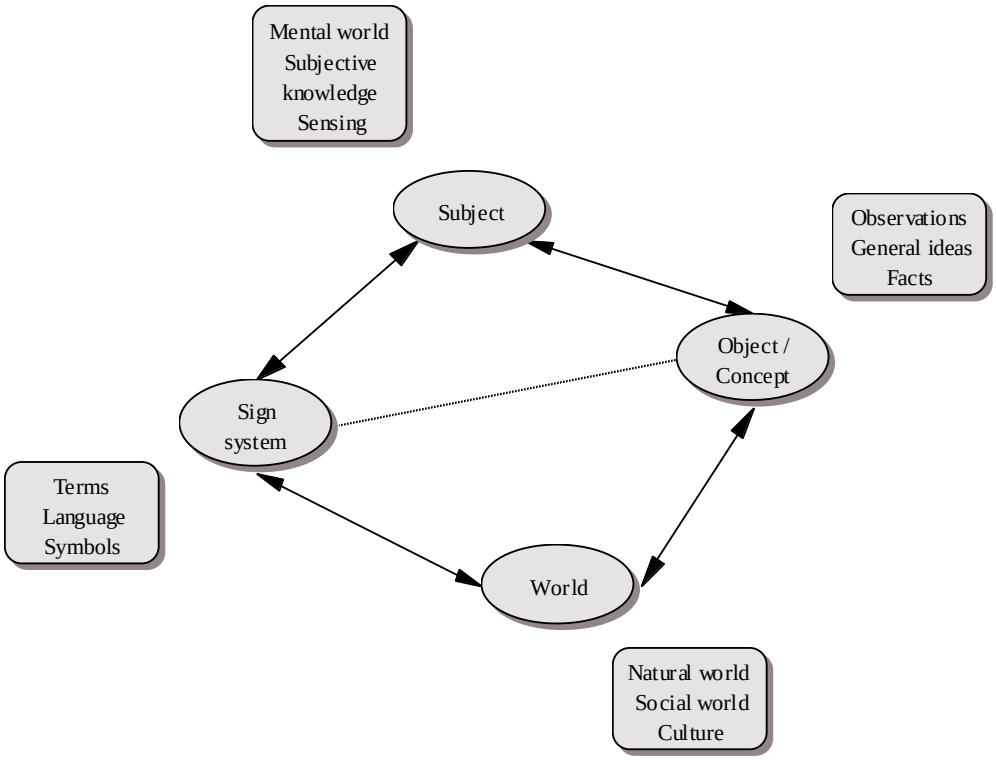


Figure 1:1: Four dimensions of understanding concepts

Firstly, in relation to the subject, concepts are intellectual, and thus implicate reasoning. Secondly concepts in order to be communicable, demand a system of communication, e.g. language. Language is considered the sign system that enables subjects to

communicate about objects. Thirdly, the concept/object dimension is considered the matter, whether abstract or concrete, that subjects communicate about when using language. Fourthly, the world dimension is considered the phenomenological world that embraces the other dimensions.

Understanding representations of knowledge as e.g. demonstrated by a KOS, thus implicates knowledge about the sign system itself, how it is structured and thus decoded, how a sign stands for an object, how it is recognized by a subject, and how its meaning is determined by the context of an outer world.

1.2 Semiotics in LIS

Semiotics is generally understood as the study of signs and sign processes. More specifically semiotics studies the interrelated properties of representation, meaning and communication. Semiotics is thus concerned with how signs become signs of meaning, how signs relate to other signs, and how signs communicate intentionally and effectually.

Semiotics has been promoted explicitly within LIS as meta-theoretical framework cf. (Brier, 1996, 1997, 2004, 2006; Mai, 2000, 2001; Thellefsen, 2004; Thellefsen & Thellefsen, 2004) and in relation to information retrieval cf. (Blair, 1990; Karamuftuoglu, 1998). Semiotics is also known in related applied fields, e.g. as social semiotics (Halliday, 1978; R. Hodge & Kress, 1988), semiotics of terminology (Myking, 2001; Wüster, 1974) and computer semiotics (Bøgh Andersen, 1990).

Brier combines the pragmatic semiotics of Peirce with second order cybernetics in order to establish a unified theoretical perspective on information science under the label 'cybercemiotics' (Brier, 2004, 2008).

According to Brier (2004), cybersemiotics combines the cybernetic functionalistic approach with a pragmatic understanding of meaning as mediated by signs, and accordingly, meaning is considered social and embodied.

Furthermore, cybersemiotics argues against the information-processing paradigm within LIS, and opposes to an objectivist and subjectivist theory of information and communication.

> *…LIS requires a theory of the cognition and communication of signification by different types of systems. Neither the objective syntactic approach of the information-processing paradigm nor the personal phenomenological approach of Machlup can deliver a framework encompassing communication processes in social, biological, and technical systems. (Brier, 2004, p. 631)*

By combining semiotics with second-order cybernetics[5], Brier introduces the concept of autopoiesis, or self-organization, to LIS. Language is itself a self-organizing and a self-reflective system. Accordingly, meaning is a result of mutual coupling between humans in society. In other words, meaning is emergent within social systems, with a common ground, that again is emergent on human social activity. Furthermore, the cybernetic view in particular addresses the concept of intentionality and the role of the observer.

I believe that the cybersemiotic view establishes a significant, profound and ambitious transdisciplinary philosophical framework that addresses the complexity of information, cognition, and communication.

The work promoted in this dissertation is in line with Brier, and is in many ways inspired by Brier in particular (Brier, 1997), however where Brier tries to establish a general unified transdisciplinary theory of information, my focus is on KO, how knowledge (or information sources) are organized and represented, which may be considered sub-ordinate in relation the ambition of a general theory of information.

In relation to KOS, Mai (2000, 2001) applies semiotic theory as a method for analyzing the process of subject indexing, with particular focus on the interpretive process.

> *Peirce's concept of unlimited semiosis states that any interpretation is based on previous interpretations and will generate new interpretations. When the subject indexing process is analyzed in terms of Peirce's idea of unlimited semiosis, the high degree of interpretation in the process is emphasized. (Mai, 2000, p. 313)*

From the perspective of semiotics, any representation relates to an intepretant even though we may distinguish between different kinds of indexing procedures, as e.g.

automatic extraction algorithms, document and content oriented indexing, user and requirement oriented indexing, and they all establish a level of interpretation.

I agree with Mai, that semiotic theory provides for a deeper understanding of the nature of interpretation; after all, semiotics may be considered a genuine theory of interpretation.

Mai provides a thorough analysis of the process of indexing from the perspective of the indexer, and appreciates Peirce's notion of unlimited semiosis as an imperative in the indexing process.

Karamuftuoglu and Blair consider semiotics in relation to information retrieval (IR). Karamuftuoglu argues that information retrieval is about communication of information, and considers semiotics as the discipline that addresses human communication by means of signs. Both Karamuftuoglu and Blair relate sign systems to language games.

The perspective presented in this dissertation appreciates the work conducted by Mai, Blair, Karamuftuoglu and Brier. The semiotic perspective seems to have an important message to tell, namely that the study of LIS and its sub-fields is attached to concepts of representation (signification), interpretation (meaning), knowledge (observations, facts, theories) and social conduct.

I therefore consider the four dimensions of understanding concepts depicted by figure 1:1 as genuinely equally important semiotic dimensions that need to be balanced in a semiotic analysis. Also the theoretical foundation of semiotics is important in order to get at clear understanding of what is actually meant by signs and sign processes.

1.3 Objectives of the Dissertation

The overall objective of this dissertation is in general terms to examine the theoretical implications of Peirce's semeiotic[6] theory and cognitive semantics; how they relate to concepts and successively whether semeiotic theory is a fruitful perspective for understanding KO and KOS.

I believe this analysis involves at least four perspectives, 1) a semeiotic perspective, that investigates into the nature of representation, 2) a library perspective, that investigates

into the characteristics of KOS, 3) a semantic perspective, that investigates into the meaning of concepts, and 4) a social/cultural perspective, that investigates into the role of domains and its implications for KOS.

1.3.1 The Semiotic perspective

Semiotics is the study of signs and how they may be meaningful to someone. Signs, however, exist at different conceptual levels, and we may at one end speak of biosemiotics, that explores the semiotic processes of life itself, and at the other end we may speak of social semiotics that explores the signs of social and communicative processes and products connected to living and acting in society.

According to Eco (1976, p. 7) '*semiotics is concerned with everything that can be taken as a sign*', in other words semiotics is about anything (a sign) that stands for something else (an object).

We may furthermore define semiotics as the study of meaning, of how signs or sign systems represents aspects of reality, and of how meaning is inferred from representations.

Semiotics may be characterized as a type of research, as a doctrine, as a theory or a set of methods (Sebeok, 1994). Therefore, semiotics may be approached differently by different disciplines, spanning from pure instrumentalism to a general principle that perfuses the universe.

The semiotic perspective promoted in this dissertation is in line with Charles S. Peirce (1839-1914), who defines a sign as something which is open for interpretation for a perceiving mind. A sign is something which stands for something else, and which produces a correlate in a perceiving mind. Therefore, a sign is something which stands in relation to an object and an interpretant (perception). Peirce's semiotic theory consists of a triadic, irreducible relation between a representamen (a sign), an object (the signified) and an interpretant (meaning). In his early writings, e.g. (CP 2.227) Peirce simply defines semiotics as the formal doctrine of signs. However, the formal branch of 'semeiotic', the name preferred by Peirce, is later divided further into 'speculative grammar', 'critic', and 'methodeutic'.

The Peirce Scholar James Lizka provides an overview of Peirce's classification of the theoretical sciences, and shows how semeiotic is part of philosophy and, furthermore, a normative science.

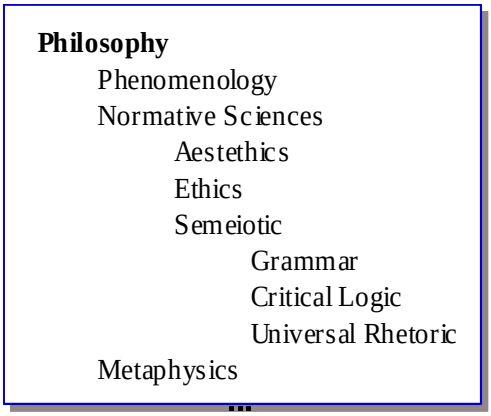


Figure 1:2: Peirce's classification of philosophy. Excerpt from the model described in (Lizka, 1996, p. 4)

Another prominent branch within semiotics, often named 'semiology' was founded by Swiss linguist Ferdinand de Saussure. As is the case with Peirce's semeiotic, Saussure's semiology is concerned with the meaning of signs. Saussure, however, perceives language as a semiotic system of differences. And the sign is divided in two, a signifier and a signified.

The point of departure for Saussure was the semiotic system of language, and a separation of the formal structure of 'langue' and its actual use, 'parole'. The fundamental differences between Saussure's semiology and Peirce's semeiotic are, however, outside the scope of this dissertation.

The present perspective regards KO as a genuine semiotic activity, an activity whose function is to organize particular information objects according to a particular sign system. Furthermore, KOS are considered semantic systems that function as mediators between information warrants and documents; KOS are thus sign systems that at different levels of granularity establish a connection between a representation, information warrants and information sources.

1.3.2 The Library perspective

KO is a core concept within LIS. It is associated with different kinds of representation systems that are designed for managing, storing and searching for different kinds of information sources. Classic knowledge organization systems (KOS) are e.g. Dewey Decimal Classification (DDC) and universal classification system (UDC) that form a distinct part in the history of LIS.

The development of modern information technology and especially the Internet has changed the information environment and the information behavior of users and producers. Concepts like digital libraries, virtual universities, e-learning, e-publishing, e-books have emerged along with the Internet and its increased possibilities for information exchange. The technological side of information is an unavoidable important factor in the 21st century's information environment.

Access to information has by today's standard in many ways become easier, in what may be called the electronic era of information, at least when it comes to finding something useful. The concept 'to Google something' or 'googling' are widespread, but the prize of ease of access and use of Internet search machines is insurmountable information overload.

KO now have to find its footing, and new role in a dynamic and ever-changing electronic information environment where fundamental concepts such as 'bibliographic control' and 'document' are under pressure. What is important, however, is that the communicative relation between a representation and an interpretation is only affected by the technology, in terms of access, speed, downloads etc. The access to information may, thus, have become easier, and some KOS may have become easier to navigate, but the cognitive process of recognizing and understanding the meaning of a representation is the same. The digital developments of the information environment and its impact on KOS is, however, not analyzed in detail, but mentioned as an aspect in the development of new KOS technologies, as ontologies and the semantic web.

For analytical purposes KO and KOS are addressed separately. This division makes it possible to discuss the theories and context of KO apart from the actual representation systems. I consider this division fruitful because developments and changes within the information environment have consequences for the development of KOS and how

information sources are represented and retrieved. The fundamental conception of knowledge, information and mediation is first and foremost related to theory and epistemology.

The function of KOS may be thought of as mediation of information sources, and defining KOS as a 'mediator' of information sources has some important implications. Firstly, it has a uniting function; systems and users are regarded in a complementary manner. Secondly, it accentuates the important relations between representation, interpretation and concepts. And thirdly, it provides KOS with a purpose that offers a different outlook on the processes of IR systems and user interaction. An outlook that is sensitive to how meaning is grounded in a community. The community thus becomes more important than the particular system or the particular user. This view is in line with the socio-cognitive (Temmerman, 2000) and domain analytical view (Hjørland, 2002b, 2004; Hjørland & Albrechtsen, 1995)

1.3.3 The Semantic perspective

> *Language is an instrument for conveying meaning. The structure of this instrument reflects its function, and it can only be properly understood in terms of its function. To study language without reference to meaning is like studying road signs from the point of view of their physical properties (how much they weigh, what kind of paint are they painted with, and so on) or like studying the structure of the eye without any reference to seeing. (Wierzbicka, 1996, p. 3)*

Semantics is the study of linguistic meaning, and is a diverse field that involves different theories and approaches to linguistics. According to (Geeraerts, 2010) five traditions of lexical semantics are predominant: historical-philosophical semantics, structuralist semantics, generativist semantics, neo-structuralist semantics and cognitive semantics.

In more general terms we may speak of strong and weak semantic theories. Where strong semantic theories seek out objective definitions of concepts, incorporating principles of formal logic, formal structures, truth value and correspondence, and thus

incorporate a high degree of semantic interoperability, weak semantic theories define concepts in relation to contextual meaning, to theories and purpose, and thus have a more relative, constructivist and pragmatic approach. According to Tredinnick (2006), strong models of representation are implicit within (L)IS.

> *Strong models of representation are implicit within librarianship, information science and computer science, and generally go unchallenged. We have seen, for example, that wihin librarianship aboutness stands in place of meaning in the creation of surrogates, and that this relies on an assumption about mimetic qualities of information and knowledge. Within information science, interpretation became understood as a subjective process after the cognitive shift, but the means by which information artefacts represent knowledge, experience or the world remained largely uninterrogated. The reliance on set logic and the Shannon model within digital computing incorporated a reductive approach to representation. All three are examples of a classical model which operates on the assumption of a direct correspondence between the tokens in symbolic systems of various kinds and the thing for which they stand in place. (Tredinnick, 2006, p. 118)*

KOS are considered semantic systems related to semantic theory, and two important aspects are considered: 1) how concepts are represented, organized and structured in KOS, and 2) how meaning is related to these representations.

Cognitive semantics is in opposition to strong semantics. It is a theoretical movement within linguistics that considers conceptual structures as embodied. Lakoff (1987) defines cognitive semantics as a philosophy of experiential realism. The meaning of conceptual structures relates to perception, culture, and motor movement.

Cognitive semantics and cognitive linguistics apply experientialism to categorization and language (Lakoff and Johnson 1980; Lakoff 1987; Lakoff and Johnson 1999) and mark a significant turning point in linguistic theory. The meaning of language is not related to objective categories in the world, or to internal formal syntax of grammar. In (Lakoff, 1987), Lakoff delivers a significant blow to the objectivistic paradigm within general linguistic philosophy.

> *On the traditional view, reason is abstract and disembodied. On the new view, reason has a bodily basis. The traditional view sees reason as literal, as primary about propositions that can be objectively either true or false. The new view takes imaginative aspects of reason – metaphor, metonymy, and mental imagery – as central to reason, rather than a peripheral and inconsequential adjunct to the literal. (Lakoff, 1987, p. xi)*

Lakoff shows, that concepts and categories are developed according to what he names idealized cognitive models (ICM) and prototypes. Categories are not objective but influenced by language and thus relative to culture and communities. Categories are not clear cut, but show prototypic features, e.g. within the category of birds, the sparrow is considered more prototypical than e.g. an ostrich.

Theory of language has been approached within LIS. Especially in relation to information retrieval (Blair, 1990, 2003). Blair bases his theory of information retrieval on the later Wittgenstein and his theory of language games, and includes aspects of semiotics. Blair considers language as a system of signs which become meaningful with reference to a particular language game. The language game establishes the context for meaningful communication. According to Wittgenstein, the meaning of concepts cannot be separated from its use within a community (Wittgenstein, 1958).

Representation of knowledge is deeply tied to language. And language is related to semiotic theory. Words and concepts are signs of meaning; however, the meaning of words and concepts is not neutral or objective, but motivated by social circumstances, perspective, language game and theory. The semantic angle discusses by what means the meaning of signs are motivated. The theory of cognitive semantics is considered because it provides an elaborate theoretical framework for addressing the biological, social and cultural aspects of meaning that is tied to linguistic signs.

1.3.4 The social/cultural/pragmatic perspective

The social perspective is important, because it investigates into how social circumstances determine the meaning of concepts.

Cognitive semantics operates with 'idealized cognitive models' (ICM) that express the conventional meaning of a concept. An ICM is determined by a cultural frame that delimits the use and meaning of a concept. The meaning of an ICM is thus socially and culturally contingent.

Peirce uses the concept universe of discourse in a similar way to delimit a social or collaborative framework. For Peirce, however, the 'universe of discourse' is a prerequisite determination of world acquired through 'collateral experience'[7], and is related to scientific facts, e.g. a theoretical framework. In this way the universe of discourse is a more precise and determinate frame, than the ICM. In a communication process, the universe of discourse is thus a determination of the utterer's familiarity with a world, acquired through collateral experience, and the perceiving mind's ditto (Liszka, 1996). Communication is possible only when the speaker and auditor exhibit a common or shared understanding of what is communicated.

The importance of social structures and shared understandings in relation to communication and meaning making is included both in cognitive semantics and semiotic theory. However, an important difference is that where Peirce argues from a philosophical perspective, according to which, knowledge is determined by scientific investigations, Lakoff argues that knowledge is structured by means of culturally determined cognitive models (ICM). It may however be possible to combine the two views, in a unified communication model.

1.4 Research Question

If KO is concerned with theories and methods for organizing and representing concepts and concept relations, and KOS, fundamentally, is the prerequisite tool for information seeking, it is significant to enquire into the character and scope of different kinds of KOS. Furthermore, if KOS's, in general, are normative semantic systems that provide for organization and control of semantic units, semantic theories should be relevant for KO. Also, if KOS's are considered intentionally to signify concepts, and, thus, systems that communicate a particular meaning, KOS's are in principle genuine sign systems that presuppose a communicative intention expressed by the KOS, a receptive effect

that presupposes an interpreting mind, and a general meaning that presupposes more than the individual mind.

From this line of thought follow, that the relation between a representation and an interpretation is a communicative process that takes place between a speaker/utterer that communicates with a certain intent, and an interpreter, which is the object for which the communication is directed. I do not at this point wish to distinguish between an oral speaker and a text (which includes KOS's) communicated by a medium. Both cases are considered acts of communication. Consequently, the signs represented in KOS are intentional, which means they are considered to communicate a certain meaning to a user. The character of this communication represented by different kinds of KOS is considered based on assumptions that emanate from different semantic approaches.

Based on this chain of reasoning, the research question is stated by the following paragraph:

If this line of thought is plausible, then what is the character and scope of representation demonstrated by different kinds of KOS? What theories of concepts in relation to KOS are at play? And also, can semeiotic and cognitive semantic theory offer a more elaborate understanding of concepts and provide for an alternative framework for how concepts may be approached in KO?

The sequential character of the research question will be approached by investigating into the character of different kinds of KOS, with a particular focus on semantic relations, and, successively, demonstrating that KOS's are related to assumptions based in concept theory. Secondly, the aim is also to demonstrate a relation between Peirce's semeiotic theory and concept theory, in particular the cognitive semantic approach as formulated by George Lakoff. Combining the two theoretical approaches provides for the development of a semeiotic communication model (the Dynacom), that demonstrates how meaning may be transferred between a speaker/utterer and a hearer/interpreter. Finally, it is investigated, by elaboration of the constituent parts in the model, how the model may be useful as an analytical framework in relation to KOS.

The last part includes a minor tentative case study that exemplifies how the model can be used as an instrument of reflection.

1.5 Methodological Considerations

As implied by the research question, the dissertation has its focus on representation and how concepts are in fact represented and organized within the context of KO.

Furthermore the research question expresses an implicit criticism of how existing theories within KO deals with concepts. Therefore, the shortcomings of dominating theory and praxis within KO will be demonstrated.

In order to approach the research question a selection of traditional and contemporary types of KOS are reviewed, based on the taxonomy suggested by Hodge (2000). Hodge's taxonomy is non-exhaustive, but it covers the main types of KOS, thus organizing the types into the main categories: 'term lists', 'classification and categorization systems' and 'relationship lists'. Thus providing an overview of how different types of KOS express concepts and concept relations, it is possible to see how they relate to concept theory.

Based in (Ereshefsky, 2001), concept theory is divided into three main categories: essentialist concept theories, cluster analytical theories and the historical approach. More elaborately, essentialist concept theories suggest the existence of clear cut objective categories, where category members share similar traits, which are considered both necessary and sufficient for category membership. Cluster analytical concept theories, are less strict in demarking category membership. Not all traits are necessarily shared by category members, and as a consequence, graded categories are allowed. This gives rise to socio-cognitive theories and models of concepts that are culturally motivated and thus contingent, and based in embodied experience. In particular cognitive semantics is given attention, because it deliberately formulates an extensive and fundamentally serious critique against essentialist concept theories. The historical approach takes a different departure, by not exclusively focusing on qualitative similarity of category members, but is instead explanation based, and thus gives priority to causality, coherence, and theoretical commitments. The semiotic approach developed

in this dissertation, is in line with the historical approach. However, it also takes the theory of cognitive semantics into account. Cognitive semantics as formulated by Lakoff (1987) and Lakoff & Johnson (Lakoff & Johnson, 1999) is therefore discussed in detail, and related to Peirce's semeiotic. From this comparative analysis, that explores the fundamental assumptions of the two approaches, the concept of significance-effect is developed. Significance-effect is inspired by Lakoff's notion of basic level categorization, metaphor and ICM; however, where basic level categorization is a fundamental structuring principle of simple categories, e.g. artifacts, it becomes more complicated when we address abstract concepts. Abstract concepts may not express basic level categorization, or the basic level of an abstract concept may be more dependent on the knowledge of the interpreter. As a consequence the concept of significance-effect is developed, based in the assumption that a concept has an effect of meaning, which is relative to what is already known by a perceiving mind. Basic level categorization, metaphor and ICM are cognitive schemes that influence and delimit the cognitive space that determines the meaning of an expression.

The concept of significance-effect is eventually elaborated and incorporated into a model of communication that is based in the interpretive level of the signification process. It is thus argued that the semeiotic approach provides for a deeper understanding of concepts and how they communicate meaning to somebody.

The principles of the theoretical developments are finally exemplified by minor case study in 'Occupational therapy' and the ending discussion relates to how this approach may be useful in relation to developing future KOS.

1.6 The Research Process

The ideas promoted and discussed in this dissertation have their roots in my master thesis from 1998, which was revised and eventually published in Semiotica (Thellefsen, Brier, & Thellefsen, 2003). In many ways, the present dissertation can be seen as a follow-up on this work.

The research process may, because of its cross-disciplinary approach, be considered atypical for a LIS dissertation. However, I have chosen to focus on aspects of KO from

a conceptual perspective, thus trying to apply theory rather than methodology, and thus focusing on understanding the complexities of conceptual systems and processes of representation, rather than 'doing' or constructing a new system. Consequently, the dissertation has the character of an explorative study that seeks to unravel assumptions and interpret their consequences for KO.

As put forward in my research question, KO is related to semeiotic and semantic theory. And the outcome of this application is the result of the research process.

I would therefore characterize the method of the present work as explorative, conceptual and analytical.

1.7 Structure of the Dissertation

The argumentative structure of the dissertation follows from its explorative nature. Chapter 2 thus has the function of providing the context for addressing KO and to characterize different manifestations of KOS. The objective of the chapter is to argue that KOS are systems of knowledge representation that build upon linguistic units, and depend on the reasoning capabilities of a perceiving mind, and, furthermore to demonstrate that KOS are systems that organize words, concepts and classes and consequently can be analyzed as systems of signification. The purpose of this chapter is also to demonstrate that the different kinds of KOS implicate different understandings of concepts and thus different approaches to representation. Chapter 3 elaborates further on how to reason about concepts and classes by discussing three general philosophical schools of scientific classification: essentialism, cluster analysis and historical classification. The purpose of this chapter is to establish a theoretical framework that connects KO to different theories of concepts and categorization. Lakoff's theory of cognitive semantics is explored as an exemplification of cluster analysis (or graded categorization) in linguistics. Cognitive semantics is in opposition to essentialism and formulates an elaborate socio-cognitive framework on concepts and categorization.

Lakoff's theory is of particular interest because it investigates how language is used within culture, and analyzes how culture plays an active role in the formation of concepts. Thus Lakoff provides us with insights about how the meaning of concepts is

motivated, structurally organized, and how concepts are connected to situations, perspectives, and cultural habits. In particular, Lakoff's idea of how concepts become meaningful to somebody is important from a semeiotic viewpoint.

Because cognitive semantics is concerned with concepts, their structuring mechanism, and how they represent meaning, cognitive semantics is considered a theory of interpretation, and may thus be related to semeiotic. The relation between cognitive semantics and semeiotic is explored further in chapter 6.

The semeiotic view as formulated by Peirce is however also related to the historical approach. And it is argued that the historical approach provides for a more elaborate and context sensitive analysis of concepts. The chapter argues that the cluster analytical approach expresses a synchronic perspective on concepts, where the historical and semeiotic approach provides for a diachronic and discursive perspective. The value of the latter is explored in chapter 4 and 5.

Chapter 4 introduces the reader to semiotics, and in particular Peirce's semeiotic theory. The objective of the chapter is to establish a general understanding of key semeiotic concepts, including Peirce understanding of 'a sign' and the fundamental division of sign triconomies and sign-classes. The taxonomy of Hodge is revisited and analyzed from the perspective of semeiotic. This analysis makes it possible to explain different types of semantic systems (KOS) as sign systems of different semeiotic complexity. The chapter connects to the discussions of concept theory, and thus consolidates the theoretical fundament of the dissertation.

Based in the theoretical fundament elaborated in the previous chapters, c*hapter 5* develops the concept of sign-displacement. The concept of sign-displacement relates to meaning and is a consequence of semeiotic reasoning. Because a sign cannot represent its object as it is by itself (objectively), but entails an interpretive element (a subject), the meaning of a sign is displaced from its object.

The chapter has a particular focus on the divisions of the interpretant and the object. The purpose is to establish a deeper understanding of the semeiotic processes related to representation and communication.

In *chapter 6* cognitive semantics is revisited and related to semeiotic. The difference between the two approaches to concepts and categorization is explored further, and the concept of significance effect is developed.

The chapter concludes in a communication model, the Dynacom, which is based in the triadic sign model, placing the universe of discourse and collateral experience as prerequisite for the possibility of significance-effect, and the occurrence of the cominterpretant.

Chapter 7 discusses how the Dynocom contributes to our understanding of KO and KOS. The constituent elements of the Dynacom is elaborated, and related to three levels of understanding. The concept of significance-effect is thus emphasized as a sub-cognitive level of understanding that relates to a universe of discourse and collateral experience. The significance-effect thus expresses a relative effect of meaning within a communication process. Also, the chapter includes a tentative case study, that exemplifies the principles of the Dynacom compared to occupational therapy.

Chapter 8 concludes the findings of the dissertation

2 Knowledge Organization and Knowledge Organization Systems

Introduction

Knowledge organization (KO) is considered a sub-area of Library and Information Science (LIS), and is concerned with numerous different systems and processes developed for organizing (or managing) knowledge. KO is generally associated with the library institutions (including digital libraries, archives and museums) and different kinds of knowledge organization systems (KOS), as e.g. the library catalogue, bibliographies, classification schemes etc. Furthermore, the different kinds of systems has been developed in different historical periods, and thus with different technological approaches. Also, they have been developed for different purposes, ranging from general universal systems, such as the DDC and UDC, to systems that are developed with a particular disciplinary focus.

The developments in KO include the perspectives of different more or less overlapping disciplines: LIS, Information Science (IS), computer science, computer linguistics, and Terminology. In this chapter I will, based on Hodge (2000), discuss the function of traditional KOS. Hodge's taxonomy of KOS is chosen because it provides a general overview of fundamental types of KOS, and furthermore it also suggests a systematic order based on semantic complexity. Also, I will demonstrate that the categorization of KOS imply a kinship with the related disciplines of computer linguistics (in particular regarding ontology and knowledge representation (KR)) and Terminology/ Lexicography.

Hodge's taxonomy is by no means exhaustive, but suggests a general overview of different kinds of KOS. Hjørland (2007b) formulates a dissimilar organization based on different theoretical approaches in KO, and thus includes the IR tradition, the bibliometrical approach, the domain analytical approach and other approaches, including semiotics, critical-hermeneutical, discourse analytical and genre based approaches. Hjørland demonstrates that KOS basically are systems that represent

concepts and semantic relations, and thus argues that knowledge about concepts and semantics is important for research within KO. Hjørland's insights are contrasted with Hodge's overview, and an organization based on 'kind', 'character' and 'function' is suggested. The field of Terminology is considered related to KO, because of its unique focus on concepts and terms. The classical onomasiological view is contrasted with the socio-cognitive view. Both views are dedicated to terminology work, but promote different understandings of how language and social activity affects the meaning of concepts.

The purpose of this chapter is eventually to demonstrate that KO includes a variety of different approaches and that KOS, despite their differences, share a common trait in being systems dedicated to systematic representation of linguistic units, concepts and knowledge. For that reason, KOS are considered semantic systems that at different levels of granularity express concept and concept relations. Also, besides demonstrating that KOS are systems that organize semantic units, it is also argued that KOS should be considered from a pragmatic perspective that takes the social nature of knowledge production and communication into account. The chapter is concluded by a section that relates the concept of representation to semiotic theory.

2.1 Defining Knowledge Organization (KO)

The field of KO is understood as a sub-area within the LIS community, having a particular focus on bibliographic representation. In Hjørland (2007b) KO is defined as the field that is concerned with construction and evaluation of semantic tools for information retrieval (IR). More specifically, KO is concerned with activities such as indexing, abstracting and classification of bibliographical items and within libraries, databases, archives etc. KO thus investigate the nature and quality of knowledge organization processes (KOP) as performed by information specialists and computer algorithms, as well as knowledge organization systems (KOS) used to organize documents, representations of documents and concepts (Hjørland, 2008).

KO thus includes a wide array of research interest, e.g. the theoretical basis of KO, the history of KO, terminological issues, domain studies, genre studies, the social

organization of the sciences etc., and as such, KO may be considered in at least two perspectives: 1) a narrow perspective that has a particular focus on the different parts of the information systems, e.g. 'metadata', 'the bibliographic record', its structure, its function, and its interrelated parts. At a more general level, there is a focus on 'the knowledge organization system (KOS)', its structure of 'subject classes' and 'concepts'. In the narrow sense, KO is related to design of information architecture and its application. Also, KOS may be universalistic as DDC and UDC, or specialized in organizing the knowledge of a particular discipline, as e.g. is the case with the 'The Dickinson Classification' (Bradley, 1968), that was designed specifically to organize collections of music at Vassar College.

KO may, however, also be considered in 2) a wider perspective that includes disciplines such as sociology of knowledge and culture studies (cf. Hjørland, 1997), literature genres and rhetoric (cf. J. Andersen, 2004), semiotics (cf. Mai, 2000), and bibliometrics (cf. Schneider, 2006).

KO in a wider perspective is interdisciplinary, and expresses a more complex and pragmatic understanding of KOS. This dissertation is mainly concerned with the wider perspective on KO, however, the structuring principles of different kinds of KOS are also considered important.

I will demonstrate that KOS are semantic systems that 1) provide the necessary structure of concepts that meets the functions and purpose of the system, and 2) that the pragmatic dimension as expressed by the wider perspective of KO provides important qualitative reflections useful for KOS design. The tenets of KO thus have two legs, a semantic leg, that in principle is dedicated to information architecture, i.e. structuring the semantic relations of concepts within the system; and a pragmatic leg, that investigates the nature of concepts, how they become meaningful and how they are used as units of communication in a social environment.

2.1.1 Knowledge Organization Systems (KOS)

Traditionally, library systems are designed from the perspective of providing physical access to documents and have their roots in the historical developments of libraries and information sources. The basic functions and the purpose of KOS can be listed as 1)

facilitation of information retrieval (IR-function), 2) providing information about documents (document information function), and 3) shelf arrangement (ordering function) (Broughton, Hansson, Hjørland, & López-Huertas, 2005).

At the general level, Hodge (2000) suggests that KOS encompass all types of systems designed in order to provide access to information sources.

> *The term knowledge organization systems is intended to encompass all types of schemes for organizing information and promoting knowledge management. Knowledge organization systems include classification and categorization schemes that organize materials at a general level, subject headings that provide more detailed access, and authority files that control variant versions of key information such as geographic names and personal names. Knowledge organization systems also include highly structured vocabularies, such as thesauri, and less traditional schemes, such as semantic networks and ontologies. Because knowledge organization systems are mechanisms for organizing information, they are at the heart of every library, museum, and archive. (Hodge 2000)*

Hodge provides a useful non-exhaustive overview of the general types of KOS and orders them in three main categories:

Term lists

1. Authority files
2. Glossaries
3. Dictionaries
4. Gazetteers

Classification and categories

5. Subject headings
6. Classification schemes, taxonomies and categorization schemes

Relationship list

7. Thesauri
8. Semantic network

9. Ontologies

Term lists: are lists of terms that provide control for variant names of an entity. 1) Authority files are lists of preferred terms and forms used for describing a bibliographic item. 2) Glossaries and 3) dictionaries contain definitions of specialized terminology, and may furthermore be useful tools for term list development. 4) Gazetteers list names of places and contain information about geographical makeup, country region, social statistics etc.

By including dictionaries in the term list category, Hodge also indicates a close relation between KOS and design and compilation of dictionaries. Or formulated differently, by including dictionaries in his taxonomy, dictionaries are considered a kind of KOS. However, dictionary craftsmanship, both regarding general dictionaries and specialized dictionaries, is usually related to the discipline of lexicography, not KO, and this relation is relatively unexplored by researchers within the field of KO. Few studies within the field of Terminology exist that link lexicography and terminology work to KO, see e.g. (Cabré, 1999; Sager, 1990). Terminology, which is closely related to lexicography, but in particular focused on standardization of terms and construction of term databases, seems also related, but is likewise unexplored.

Classification and categories: 5) Subject headings are words and phrases which constitute a controlled vocabulary. Subject headings are used in catalogues to describe the subject of a document. Subject headings may be general as LCSH[8] or specialized as TOTSH[9] or MESH[10]. 6) Classification and categorization schemes provide subject sets, while the terms classification schemes, taxonomies and categorization schemes are often used interchangeably (G. Hodge, 2000), but the terms ‘taxonomy’ and ‘categorization’ may also suggest other connotations than bibliographical classification schemes, e.g. biological taxonomy and linguistic categorization. However, the most important function of KOS under the category of ‘classification and categories’ is its particular focus on hierarchical relations.

Relationship lists: has as ‘term lists’ a particular focus on semantic units. As indicated by the category, relationships between terms are the primary function. These relationships can be hierarchical and associative. Furthermore, the different kinds of

KOS that fall under this category also provides authority control, and thus includes, from an analytical perspective, the functions of both 'term lists' and 'classification and categories'. 7) Thesauri are controlled vocabularies that, beside authority control, express hierarchical relationships of concepts and add associative relations to other concepts in the system. One may say that thesauri express both vertical (hierarchical) and horizontal (associative) relations, where classification systems primarily are focused on the hierarchical organization of concepts. 8) Semantic networks and 9) ontologies are not normally considered genuine KOS, but are associated with computer linguistics and formal knowledge representation (KR). Ontologies and semantic networks are systems that are able to express subject categories and concepts with even greater precision than thesauri normally do.

Hodge's taxonomy of different types of KOS suggests that KOS as research field goes beyond a narrow LIS perspective. And if this assumption is correct, KOS should be considered interdisciplinary internally as well as externally, where new developments may be motivated by theories imported from other sciences, as e.g. sociology, philosophy and linguistics, but also inspired by technologies developed in other disciplines, in particular computer science and applied linguistics.

Other kinds of KOS apart from the kinds suggested by Hodge are bibliometric maps, concept maps, topic maps, folksonomies etc. In particular the value of bibliometric maps has been discussed by Hjørland (2002a). These other kinds should all be considered types of KOS within the category of relationship lists.

In the following section I will exemplify Hodge's three main categories of KOS, and discuss their practical and theoretical implications. The section is concluded by an investigation of the related approaches: Ontologies and knowledge representation (KR).

2.1.2 Term Lists

Term lists are lists of terms that provide control for variant names of an entity. According to Hodge (2000), authority files, glossaries, dictionaries and gazetteers belong to the category of term lists. Authority files are defined as approved terms for describing a bibliographical item; authority files ensure consistent use of proper names and concepts, and connect various terms that are inherently intertwined. Authority files

provides for preferred term for equivalence, hierarchic and associative relationships, meaning that it relates variant terms for the same concept, and selects an authoritative one as the main term (Hagler, 1997). Authority files are helpful when searching databases where similar items may be named with variant terms.

Glossaries and dictionaries are tools that provide definitions of terms, and are useful tools for identifying reliable candidates for a controlled vocabulary.

As argued, Terminology and lexicography are related disciplines of KOS. Terminology is in particular dedicated to standardization of terms and development of term databases. Lexicography is on the other hand dedicated to crafting dictionaries.

An important distinction between the category members is that authority files are thought as controlled vocabularies, made for searching a database, where glossaries, dictionaries and gazetteers are descriptive or prescriptive, and is produced for purposes different than searching databases.

For analytical purposes, we may argue that term lists are particular types of KOS that have the function of defining a semantic unit (dictionaries, glossaries, gazetteers), and controlling a vocabulary and its semantic relations (authority files).

2.1.3 Classification and Categories

'Subject headings' is a type of pre-coordinate vocabulary used to organize bibliographical items. As is the purpose of term lists, the function of subject headings is to assist the search for information using a controlled vocabulary; however, the technology was developed in the post-online era, and thus essentially based on the tradition of Charles A. Cutter (Cutter, 1904), meeting the requirements of manually searching a library catalogue. Subject headings use a single word and/or phrase to represent a particular subject or concept. Subject headings may be an outdated technology, however, it is still used e.g. by Library of Congress (LC). LCSH is the vocabulary most widely used within library cataloguing. Mainly because of economical factors, but also because it is a user friendly tool for indexing and for quickly and easily locating something relevant to a request (Hagler, 1997).

The purpose of subject headings is to catalogue the content of documents according to the vocabulary. However, subject headings identify concept(s), not documents, and are thus conceptual.

LCSH also provides for semantic relations as equivalence (synonym or near synonym), generic relations (broader term BT/ narrow term NT) and associative relations (related term RT), and thus includes the functions of the thesaurus.

Traditionally, within classification theory, one distinguishes between enumerative and faceted classification[11], which refers to the principles of structuring concepts, and universal vs. specific classification, which refer to the level of specificity. Where universal classification systems aim at organizing all knowledge in a library system as e.g. DDC and UDC, the specified classification systems aim at organizing a particular subject area or a discipline.

Also, the ambitions of the different kinds of systems are different. The DDC was developed in a historical period where no unified library system existed. Every library thus maintained their respective local organization system. The DDC was developed from the perspective of library management, with a particular focus on usefulness, standardization and cost reduction. Milvin Dewey (1851-1931), the father of the DDC, insisted on practical techniques and effectiveness, thus giving priority to the internal structure of the system rather than revising it according to the developments in knowledge itself. Also, the first edition of DDC was created in 1876, where the information environment was different, where physical access to documents was the priority and thus management of a library document collection was essential. The subsequent 22 editions have gradually changed the system considerably, in particular due to the severe growth of knowledge production in the 20th century. Furthermore, documents have become increasingly specialized and genre specific, thus putting pressure on the specificity of subject classes. In the era of digital information, DDC is still in development, and is continuously adjusting to the developments of information sources, refining the structure of its subject classes, and it is still widely used by public libraries.

The UDC, was initiated by Paul Otlet and Henri La Fontaine, and represents a modified and enhanced version of the DDC, with a particular focus on knowledge and knowledge production within scholarly communities.

> *In contrast to the foregoing practices associated with typical general library classification schemes, Otlet and La Fontaine dealt with specialist articles from the start and not simply in a few cases but rather in the great majority of cases. Further, they believed that scientists and specialists were only interested in materials at confined (specific) levels. (Miksa, 1998, p. 54)*

The enhancements of the UDC were the introduction of subject facets in the universal classification system, thus making it possible to express more complex subject descriptions by means of numbers.

As recently discussed by Ducheyne (2005), Paul Otlet subscribed to an objectivist epistemology that assumes the possibility of a universal classification of all human knowledge.

In many ways, traditional library classification has been challenged by new information technology and the era of the Internet. The importance and influence of DDC and UDC within the library community is, however, undisputed; but the strength of the systems is their focus on subject classes, the hierarchical organization of concepts, and their management facilities by the use of decimal number notations.

The DDC and UDC are mentioned because of their historical importance and prevalent status within library classification. However, also subject specific or disciplinary classification systems exists, and in many cases the DDC or UDC are impractical if the focus is on a particular subject area. Also, specialized classification systems may be closer related to the subject area, the discourse community, the discipline, etc. they tend to organize.

Classification systems are conceptual and express a perspective on how subject classes are organized, sub-divided and related within the system. In summary, classification systems order items according to subject classes based on some properties. They may be universalistic or specific to a domain, and they specify generic relations between

classes. Classification systems are ordered systematically, with an alphabetical index; they are normative and specify classes.

2.1.4 Relationship Lists

Like term lists, the thesaurus is a controlled vocabulary. It differs, however, from the term list by its more developed structure.

Traditionally, a thesaurus is defined as a semantic tool that offers the user a systematic representation of concepts, e.g. by establishing a hierarchical outlook from general to more specific concepts. The thesaurus normally contains information about conceptual relations by using the following operators:

BT – Broader term
NT – Narrow term
RT – Related term
SN – Scope note
USE – Authority control

A thesaurus is usually domain specific and is a tool designed for subject indexing and for searching a bibliographical database. Therefore a thesaurus should be based on a thorough understanding of the information environment (Lykke Nielsen, 2002). How this understanding may be established has been discussed by (Hjørland, 1998, 2007b; Jacob, 2001; Jacob & Shaw, 1998).

The methodology used to identify appropriate concepts can be based on empirical investigations of different kinds. One may ask domain experts within a particular subject field in order to identify concept candidates for a thesaurus or one could analyze a corpus of documents and investigate domain specific dictionaries and encyclopedia or even combine the approaches. Lykke Nielsen (2002), showed how the concept of the association test can be of value as methodology for identifying important concepts in a larger medical corporation. This approach incorporated users from different areas of the corporate organization.

The process of identifying appropriate semantic categories is thus normally based on empirical investigations or different kinds of warrants. The generation of conceptual categories that may be used as descriptors in indexing can successively be explained by relating them to broader or narrower terms, thus providing the system with a top down logic. The top level terms mark the ontological boundary of the system.

A thesaurus may also contain facets (thesaurofacets[12]) and information about polyhierarchies[13]. The following example illustrates the structure of a Thesaurus. The example is provided by (Hunter, 2000, p. 8):

Water Sports
BT Sports
NT Boating
NT Sailing
NT Swimming
NT Waterskiing
NT Windsurfing
RT Air sports

The same structure can also be reflected by a diagrammatic tree structure:

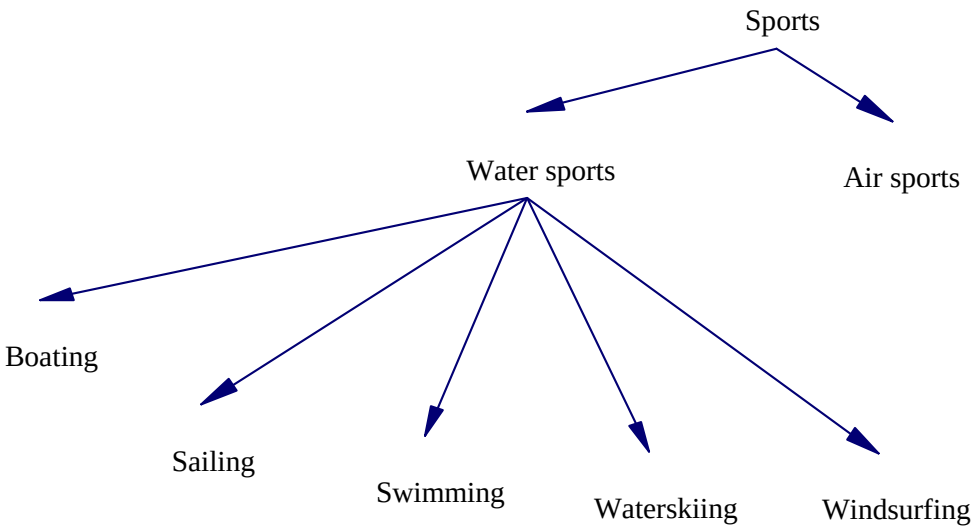


Figure 2:1 Diagrammatic tree structure of 'Sports' example

The point made by Hunter is that the thesaurus explicitly expresses semantic relations, but also contains a classificatory hierarchy demonstrated by the implicit tree structure.
As suggested by the example, the thesaurus proposes hierarchical relations (BT, NT), supplemented by the associative relation (RT). However, even though the associative relation is a key functionality within a thesaurus structure, it is also extremely ambiguous and may include e.g. 'causal relation', 'similarity', 'processes', 'location', 'time space continuum', etc.
These qualitative aspects are specified in faceted classification (as facets) and in ontologies.
In particular Dagobert Soergel have worked with the transition of thesaurus and classification schemes from traditional KOS to new semantic tools by taking advantage of the formal specifications demonstrated by ontologies. Soergel et al. (2004), summarizes the limitations of traditional KOS as follows:

- *Lack of conceptual abstraction*
- *Limited semantic coverage*
- *Lack of consistency*
- *Limited automated processing*

By applying the specifications of relationships of ontologies to thesauri, it is possible to overcome these limitations and provide for a more extensive and semantically rich knowledge representation that ultimately improves information organization (indexing) and retrieval.
Soergel's research marks the transition of KOS from an 'analogue' to a digital information environment. Also, this transition creates a bridge between the traditional conception of KOS and more developed and technologically advanced semantic tools, taking ontologies and knowledge representation into account.

2.1.5 Related Approaches

1. Semantic networks
2. Ontologies

3. Knowledge representation

2.1.5.1 Semantic network

As argued by Hodge, a semantic network is considered a type of KOS in the category of relationship lists.

A semantic network or net is a graphical notation representing concepts and concept relations. Semantic networks are related to computer science and artificial intelligence, and are used within machine translation. Semantic networks are thus used to represent knowledge or to support automated systems for reasoning about knowledge (Sowa, 2000). According to (Salem & Alfonse, 2008), semantic networks are declarative, thus providing reasoning capacities to the system. Ontologies are on the other hand a vocabulary, often specialized to a domain or a subject matter. Ontologies represent concepts within a domain and the relationships between them.

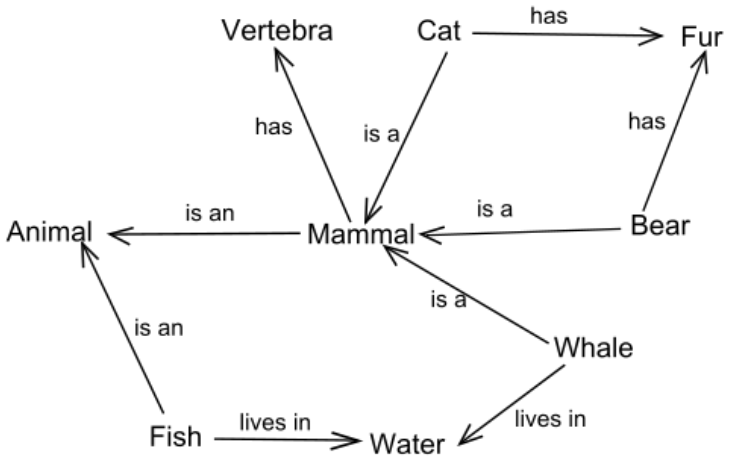


Figure 2:2: Semantic network as demonstrated in Wikipedia[14]. The figure expresses a simple example of a semantic network.

The relations demonstrated by the example (fig. 2), show part-whole relationship [Mammal has Vertebra], categorical membership [Cat is a Mammal] and locative relation [Whale lives in Water].

Semantic networks may also be more complex and detailed, and dedicated to different purposes. However, common to all semantic networks is their declarative graphical form of representation. Some are, as demonstrated by the example, informal, expressing

general generic relations, and other kinds are highly formally defined systems of logic. Sowa (1992), identifies six common kinds of semantic networks: Definitional networks, assertional networks, implicational networks, executable networks, learning networks and hybrid networks. Figure 2:2 demonstrates a definitional network, the other kinds are closely related to formal logic, computer science and AI.

2.1.5.2 Ontologies

The concept 'ontology' originates from philosophy, and within this context ontology relates to metaphysical statements about reality or existence. An ontology thus constitutes the epistemic threshold for reasoning.

Within information science, ontologies are considered semantic tools that describe a particular part of the world by formal specifications. The threshold is here delimited to a particular information system.

The concept 'ontology' as tool for knowledge organization has lately been put forward and discussed in the LIS literature, especially with reference to the 'semantic web' (G. Hodge, 2000; Soergel, 1999; Vickery, 1997). Recently, the concept has been included in the '*Encyclopedia of library and information science* ', where Bruijn & Fensel (2005) defines the ontologies in the following manner:

> *An ontology is a formal explicit specification of a shared conceptualization [and] A conceptualization is an abstract simplified view of the world that we wish to represent for some purpose. The ontology is a specification because it presents the conceptualization in a concrete form. It is explicit because all relevant concepts and constraints of the domain are explicitly defined. It is formal which means that the ontology should be machine processable. It is shared – the ontology captures consensual knowledge. (Bruijn & Fensel, 2005, p. 1)*

According to this definition the ontology restricts itself to a particular and specified domain of knowledge.

In many ways an ontology resembles the different types of the semantic systems discussed above. One could argue that the facet analytical approach to classification is

very similar to the logic of ontologies; however, there are different views on how to define and delimit the scope and role of ontologies as semantic tools within LIS. Poli (1996), suggests the following distinction of ontologies:

> *…an ontology is not a catalogue of the world, a taxonomy or a terminology. If anything, an ontology is the general framework within which catalogues, taxonomies, and terminologies may be given suitable organization. (Poli, 1996, p. 313).*

Poli here defines ontologies as top-level categorizations, and general frameworks for knowledge organizing systems. However, other scholars want to include all specific concepts in an ontology in order to reveal distinct formal relations between concepts, see (Guarino, 1995, 1997; B. Smith, 1995; Barry Smith, 2003; Uschold, 1998; Uschold & Gruninger, 1996). As expressed by Vickery:

> *Another distinction among those working in this field is between those who aim to build a general ontology, taking all knowledge for its province, and those who are concentrating on an ontology for a specific domain – a distinction analogous to the makers of general and special classifications in our field. (Vickery, 1997, p. 279).*

Vickery's statement is in line with (Bruijn & Fensel, 2005), and suggests that ontologies have at least three different layers of abstraction. We may speak of top-level ontologies that capture domain-independent knowledge, e.g. PMEST[15] as proposed by Ranganathan. Mid-level ontologies are domain ontologies that provide for definitions and relations between domain dependent concepts, e.g. medical ontologies. Sub-level ontologies are ontologies specified for e.g. an application, i.e. an ontology representing the structure of a particular web site (Bruijn & Fensel, 2005).

In (Grenon & Smith, 2004), basic formal ontology (BFO) are divided into the concepts of SNAP and SPAN. SNAP relates to time, as instances (or snapshots) in a continuum; SNAP thus provides for a series of snapshots i.e. synchronic representations of entities existing at some given instant. The SPAN ontology is defined as the totality of

processes. SNAP distinguishes different sorts of parts of substances, SPAN distinguishes structural parts of processes. The point made by Grenon & Smith is that a focus on instances and their parts gives priority to a particular structure between substances, and a focus on the relations between substances and their parts gives priority to processes exhibited by substances. In medical science, the relations between objects are important; for instance, a particular drug may have a particular intended effect, but also have side effects. These effects may be seen as consequences of the object in the ontology.

Besides reflecting knowledge at a particular level of granularity, representation systems may be arranged as suggested by (Bruijn & Fensel, 2005), by level of formalization. A term list provides for a low level of formalization (authority control), the thesaurus provides for a more developed level of formalization, supplying terms with synonymic, hyponymic and generic relations. Ontologies express an even more developed formalization, for instance are so-called expressive ontologies highly formalized and contain detailed relationships between concepts, allowing for higher order logic and computation. What particularly adds to the functions of formal ontologies compared with the thesaurus is the advanced expressiveness that includes description logic together with web technology such as XML[16] and RDF[17].

The development process of creating ontologies follows as suggested by (Noy & McGuinness, 2001), seven steps:

1. Determine the domain and scope of the ontology
2. Consider reusing existing ontologies
3. Enumerate important terms in the ontology
4. Define the classes and the class hierarchy
5. Define the properties of classes—slots [attributes]
6. Define the facets of the slots
7. Create instances

These steps, however, resemble the process of thesaurus construction, but what differentiates the construction of an ontology from e.g. the thesaurus is the more detailed specification of hierarchies and semantic relations of classes/concepts.

Ontologies are designed for the digital information environment. It is closely related to computational linguistics and the semantic web, and provides for a well-defined semantic structure and a precise description of concepts, concept properties and concept relations.

The advantage of domain specific ontologies is semantic interoperability. By specifying the meaning of concepts by stating generic and semantic relations, the meaning of concepts can be represented with greater precision.

In relation to KOS, the ontology reduces semantic ambiguity by allowing unique identifiers to be assigned to each concept. Concepts and their relations are explicitly defined as unique entities, and the ontology thus provides for internal structural consistency and clear semantics that allow for interoperability between different KOS. (Soergel, et al., 2004).

2.1.5.3 Knowledge Representation (KR)

Knowledge representation (KR) originates from computer science and is a key concept within contemporary computational linguistics and is related to logic, semantic networks, frames and conceptual graphs. (Sowa, 1999). KR provides us with the basics of conceptual modeling. KR accordingly expresses a formal language which is applied in order to gain control and organize units of knowledge in a systematic and uniform way. The purpose of KR is expressive adequacy and notational efficiency. Expressive adequacy refers to whether a method is capable of describing or representing all kinds of information needed in a knowledge representation. The notational efficiency concerns the syntactic use of the language (Liu, 2000).

Technologies as ontologies and semantic networks are considered essential models of KR. However, KR has with increasing effect also surfaced in the KOS literature (Ding, 2001; Gilchrist, 2003; Morrissey, 2002; Poli, 1996; Soergel, 1999; Soergel, et al., 2004; Vickery, 1997).

Davies et al. (1993), lists five distinctive roles of KR:

- A knowledge representation (KR) is most fundamentally a surrogate, a substitute for the thing itself, used to enable an entity to determine consequences by thinking rather that acting, i.e., by reasoning about the world rather than taking action in it.
- It is a set of ontological commitments, i.e., an answer to the question: In what terms should I think about the world?
- It is a fragmentary theory of intelligent reasoning, expressed in terms of three components: (i) the representation's fundamental conception of intelligent reasoning; (ii) the set of inferences the representation sanctions; and (iii) the set of inferences it recommends.
- It is a medium for pragmatically efficient computation, i.e., the computational environment in which thinking is accomplished. One contribution to this pragmatic efficiency is supplied by the guidance a representation provides for organizing information so as to facilitate making the recommended inferences.
- It is a medium of human expression, i.e., a language in which we say things about the world.

(Davis, Shrobe, & Szolovits, 1993, p. 17)

Where an ontology is concerned with the existence of an object, KR is concerned with modeling and reasoning about objects and concepts. As stated by Davies et al., the function of KR is to determine how to think, rather than act in the world, and as such a KR is considered a metal model of the world.

KR differs from the other kinds of KOS by being dedicated to formal modeling. It provides description logic for organizing information and facilitates inferential processes. It is, thus, not in itself a KOS, but a semantic tool that may enhance the efficiency of KOS.

2.2 KOS and semantic relations

Semantics is considered the study of meaning in language. However,

> *The study of linguistic meaning is generally divided in practice into two main fields, semantics and pragmatics. Semantics deals with the literal meaning of words and the meaning of the way they are combined, which taken together form the core of meaning, or the starting point from which the whole meaning of a particular utterance is constructed. Pragmatics deals with all the ways in which literal meaning must be refined, enriched or extended to arrive at an understanding of what a speaker meant in uttering a particular expression. (Kearns, 2000, p. 1)*

Semantics, thus, expresses and determines the meaning of terms and concepts, and maps the structure of concepts and their relations to other concepts. Pragmatics deals with how meaning is achieved in communication, and how it is determined and refined by context; where semantic deals with determination of meaning, pragmatics deals with understanding.

According to Martinich (1996), philosophers distinguish between three areas of the study of language: syntax, semantics and pragmatics. Syntax may be considered synonymous with 'grammar', and studies the rules that describes well-formed sentences in purely formal terms (ibid., p. III). Semantics studies the meaning of linguistic expressions in relation to 1) its reference (extension), 2) its truth value, 3) its intension, and 4) its relation to what a competent user of an expression must know (e.g. being able to recognize the structure and building blocks of a sentence). Pragmatics studies the context dependent features of language, and presupposes knowledge that goes beyond the semantic structures. In table 1, the three areas of study are summarized with reference to Charles W. Morris, who originally formulated the distinction between the areas within the philosophy of language.

• Syntax or grammar (relation between signs)   o Studies words and sentences

• Semantics (the relation between signs and the world)
  o Includes syntax
  o Studies propositions and the reference to an object/concept

• Pragmatics (how signs are determined by use)
  o Studies the linguistic act and the context in which they are performed
  o Studies the context-dependent features of language

Table 1: The interdependent dimensions of language: syntax, semantics and pragmatics after Charles W. Morris (1946)

Where syntax studies the characteristics of words and sentences (form and syntax), semantics study the meaning of concepts. Semantics is concerned with the determination of concepts (intension), how they relate to objects (reference), and the particular items that fall under a concept (extension). Pragmatics is concerned with how concepts are determined by use, how meaning depends not only on syntax and semantics, but involves the context of how concepts are used in communication including the intention of the communicator and the motivation of the receiver. The pragmatic aspect is unclearly addressed in most kinds of KOS. However, the thesaurus may provide for context information by means of scope notes.

In a KOS context, the meaning of concepts is determined by semantic relations. The traditional kinds of KOS (authority files, classification systems and thesauri) normally include at least equivalence (synonymic), generic (hierarchical) and associative relationships. The contemporary kinds of KOS (ontologies and semantic networks), may include several more specific, semantic relations. The general kinds of semantic relations relevant for KOS are listed below:

- Synonymy – the word A expresses the same as word B. (equivalence)
- Polysemy – a word is polysemious if it has multiple related meanings.
- Antonymy – a word with the opposite meaning e.g. rich / poor, or fat / thin.
- Hypernymy – a word that includes a subset of subordinate terms, e.g. Martial Arts is hypernym to Ju Jitsu or Karate. (is also determined a 'Is-a relation').

- Hyponymy – A is a hyponym of B if the meaning of B is part of the meaning of A and A is a subordinate of B. (is also determined a 'has part relation).
- Holonymy – names a whole where meronymes names its parts.
- Meronymy – means part of a whole (is also determined a 'part of relation').
- Acronymes – abbreviations, e.g. LIS is acronym for Library and Information Science.
- Locative – the location of an object e.g. A being placed in B

However, other important kinds of semantic relations that, according to Hjørland (2007b), may be considered pragmatic are:

- Scholarly, paradigmatic or discourse specific
- Specific to specific empirical languages (e.g. national languages, or language for special purposes (LSP))
- User oriented, e.g. a company, a work group (corporate language, jargon)

And according to (Thellefsen, 2009; Thellefsen, et al., 2003; Thellefsen & Thellefsen, 2004)

- Semeiotic

The pragmatic kinds of semantic relations, however, require more than descriptive and declarative knowledge about the domain investigated. It is outside the scope of the dissertation to investigate into the kinds suggested by Hjørland; however, the semeiotic approach is at the core of the dissertation, and includes several aspects suggested by Hjørland.

Different kinds of KOS meet different demands and serve various knowledge interests and they are approached with different expectations. The different purposes of KOS are determined by their contexts of use, i.e. in relation to a particular task; a dictionary may be useful if information about a word or a concept is sought, a thesaurus is useful in relation to searching information by means of a controlled vocabulary in a database.

Semantic networks (or conceptual graphs) are useful tools for modeling or mapping generic structures of concepts. Table 2 provides an overview of the characteristics of the different kinds of KOS.

KOS	**Relations**	**Semantic order**	**Is characterized by**
Term lists	Synonymy Polysemy Homonymy (some include generic relations as hypernymic and meronymic relations)	Alphabetically Orders words/terms	Controlled vocabulary Authority control Prescriptive General or specific
Dictionaries & glossaries	In principle all kinds of semantic relations dependent on the type of dictionary	Alphabetically Orders words/terms	Definition of terms and concepts, by means of terms and concepts. Characterized by being either descriptive or prescriptive Related to Leksikography General or dedicated specialized functions dependent on the type of dictionary
Classification systems	Primarily generic relation: • Hypernymy • Hyponymy • Holonymy • Meronymy	Systematically Orders classes	Controlled vocabulary Authority control Specifies generic relations between classes Prescriptive Universal or specific
Thesauri	Includes the functions of term lists and the generic relations of classification systems. Adds associative relations	Alphabetically Orders concepts and structures concepts systematically	Controlled vocabulary Authority control Prescriptive and specific Weak semantics (RT)
Semantic networks (concept network)	In principle include the relations demonstrated by the thesaurus The relations however are expressed formally, and allows computation	Systematically Represent concepts using graphical notation that reveals semantic relations	Graphical representation of semantic relations among concepts Prescriptive and specific Uses formal language or description logic

Ontologi	May in principle include the full spectrum of relations demonstrated by the other kinds of KOS	Systematically	Formal representation of concepts and its relations within a domain Prescriptive Related to KR General or specific Formal language or description logic (strong semantics)
KR	Expresses possible relations by means of formal logic	Systematically	Provides a set of ontological commitments Is a medium for efficient computation Uses description logic Related to AI and computer science Used in ontologies

Table 2: Specification of semantic relations of KOS

According to Hodge (2000), dictionaries and glossaries are considered types of KOS because they offer either descriptive or prescriptive information about words and concepts. However, the category of dictionaries and glossaries include numerous different kinds that serve diverse specialized functions and thus meet different user needs[18]. Dictionaries are not in particular designed as tools for information seeking, even though they may be helpful for users seeking information.

KOS deal with controlling the meaning of concepts, how they are related to other concepts/objects, and how they may be used as descriptors or units of classification in databases. However some KOS are more concerned with standardization of concepts and semantic relations, and other kinds are more closely related and thus more sensitive to progress and alterations of concepts within a domain.

Following the taxonomic structure of table 2, the ontology may be considered the most inclusive and developed kind of KOS that, depending on level of granularity, may incorporate the semantic structures of the other kinds of KOS. It may also be argued that where term lists and classification systems are types of KOS well suited for the analogue information era, the relationship lists is a direct consequence of the increasing importance and development of digital information, and the online era.

In summary we may argue that semantics is concerned with prescribing the correct use and meaning of particular words and concepts and how they may be combined. Pragmatics is concerned with how concepts are understood and used within communities. The latter dimention is essential from a semeiotic perspective.

2.3 KOS and Terminology[19]

A discipline closely related to KO is Terminology. Terminology is also related to linguistics; however, it differs by its exclusive focus on LSP. As KOS, Terminology is also dedicated to the organization concepts, but is in particular concerned with standardization of concepts.

Modern Terminology emerged in the 1930 with the work of Eugene Wüster (1898 – 1977) in Vienna. Wüster was dedicated to Esperanto and his ideas of 'Terminologie Lehre' was driven by the ambition of standardizing technical language to an extent, that, rendered scientific communication more effective and independent of national language and dialect. In his Doctoral dissertation, Wüster established the methods and principles for Terminology, which aimed at standardization of scientific language.

> *Wüster considers [T]erminology as being located at the intersection of linguistics, logic, ontology, information science, computer science and individual disciplines. The interdisciplinarity of [T]erminology is determined by the characteristics of terminological units, which are simultaneously language units (linguistics), cognitive elements (logic and ontology, i.e. part of cognitive science) and vehicles of communication (communication theory). Terms appear in specialized communications (information science) and computers are usually employed in terminographic activity (computer science). (Cabré, 1999, p. 25)*

The classic view of Wüsterian Terminology implies three conditions. The first condition emphasizes the focus on the concept.

> *Ausgehen von den begriffe. – Erstens: Jede Terminologiearbeit geht von den* ***Begriffen*** *aus. Sie zielt auf scharfe Abgrenzung zwischen den*

> *Begriffen. Das reich der Begriffe wird in der Terminologie als unabhängig vom Reich der Benennungen (= Termini) angesehen. Daher sprechen die Terminologen von Begriffen, während die Sprachwissenschafter in bezug auf die Gemeinsprache von Wortinhalten sprechen. (Wüster, 1985, p.: 1, p. 1)*

According to the first condition, each terminological work proceeds from the concept (the onomasiological view). It aims at a sharp demarcation between concepts. The area of the concept is regarded as independent of the area of designation. The terminographer speaks of concepts, while the linguist speaks of word content.
This condition thus implies that concepts can be clearly and exclusively defined, that they are language independent, and, consequently, abstract, cognitive entities referring to objects and relation of the real world.

> *Terminology shares with logic a basic interest in concepts. As opposed to semantics, which is interested in the name-meaning relationship, terminology is primarily concerned with the relationship between objects in the real world and the concepts that represent them. (Cabré, 1999, p. 8)*

The focus of moving from concepts to terms distinguishes the methods used in Terminology from methods used in lexicography. The former aims at naming concepts, where the latter, lexicography, starts with the word, i.e. a dictionary entry, and describes its functional and semantic aspects. Moving from word to concept is the opposite direction of Terminology, and is described as a semasiological approach.
The second condition stipulates the naming function of Terminology and goes as follows:

> *Beschränkung auf den Wortschatz. – Zweitens: Der Vorrang der Begriffe in der Terminologie bewirkt auch eine andere Einstellung gegenüber dem sprachlichen Ausdruck. Nur die Bennennungen der Begriffe, der* ***Wortschatz****, ist den Terminologen wichtig. Flexionslehre und Syntax sind es nicht. Die Regeln hierfür können aus der Gemeinsprache übernommen werden. (Wüster, 1985, p.: 2, p. 2)*

Focusing on the concept consequently reduces the linguistic expression to a naming function. The vocabulary is important to the terminographer, whereas inflection and syntax is not. Inflection and syntax lies within the domain of general language, and is thus ignored within Terminology.
Finally, the third condition follows from the two previous conditions:

> *Synchronische Sprachbetrachtung. – Drittens: Der Vorrang der Begriffe hat zwangsläufig dazu geführt, daß die terminologische Sprachbetrachtung* ***synchronisch*** *ist. Für die Terminologie ist das Wichtigste an einer Sprache das Begriffsystem, das ihr zugrunde liegt. (Wüster, 1985, p. 2)*

The priority of concepts leads to the fact that the language view in terminology is synchronic. In Terminology, the concept system is of greatest importance.
Wüster's view on the conditions for terminology is summarized in the following model that demarcates four fields. The vertical line demarcates the border between meaning and representation (symbol), and the vertical line demarcates the border between individual objects and different forms of representation and concepts and symbols. The field of individual objects or entities is represented by a1, a2 …, the field of meaning by A1, A2 … This means individual concepts express the properties of the individual objects, which eventually are generalized by the top level, concept A, again expressing a set of characteristics common to A1, A2 …. B constitutes the linguistic symbol that represents the meaning of A. B is assigned to A, and A is the meaning of B. B1, B2… are individual concepts, and b1, b2… represent different forms of B.

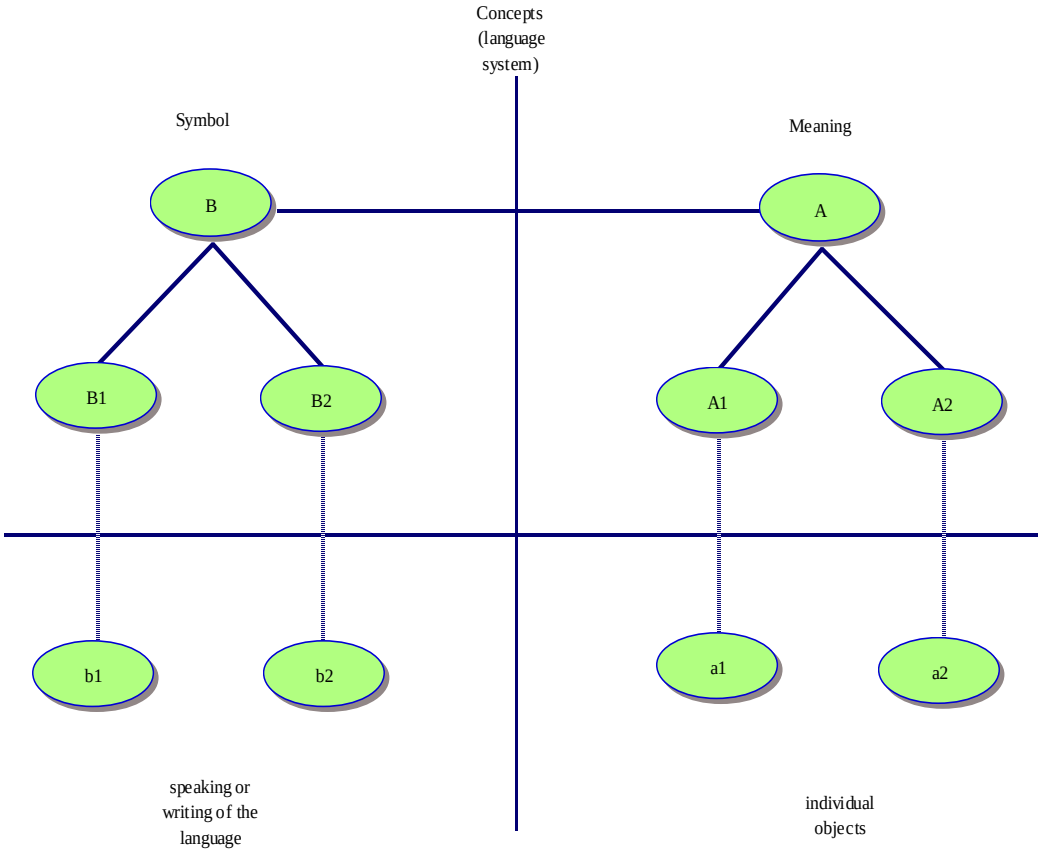


Figure 2:3 Wuster's term model, translated by Felber 1980 (Felber, 1984, p. 100)

As we may recall, the concept is prior to symbolic representation. Wüster defines the concepts as elements of thinking, a mental construct representing a material or immaterial individual object.

> *Concepts are mental representations of individual objects. A concept may represent only one individual object or – by abstraction – comprise a set of individual objects having certain qualities in common. It serves as a means for mental ordering (classification) and with the aid of linguistic symbol (term, letter, graphical symbol) for communication. The concept is therefore an element of thinking. (Felber, 1984, p. 115)*

Furthermore

> *Concepts may be the mental representation not only of beings or things (as expressed by nouns), but, in a wider sense, also of qualities (as*

> *expressed by adjectives or nouns), of actions (as expressed by verbs or nouns), and even of locations, situations or relations (as expressed by adverbs, prepositions, conjunctions or nouns). (ibid, p. 115)*

The methodologies of terminology work are considered either descriptive or prescriptive. However, it may be difficult to make a clear distinction, because even descriptive terminology may be used in a prescriptive manner (Felber, 1984).

The onomasiological approach to terminology work considers concepts in their abstract and variate form and their relation to other concepts, and eventually selects an appropriate linguistic representation, a term as a signifier for one concept.

The ambition of Wüster's Terminology work is based in the idea of formalizing and standardizing technical language in order to minimize unclear scientific communication, and from this perspective a terminology will always include a prescriptive function.

Within KO, in particular Ingetraut Dahlberg has developed principles of concept analyses based in the work of Wüster cf. (I. Dahlberg, 1978; I. Dahlberg, 1994)

Sociocognitive terminology is formulated as an alternative to Wüster's Terminology. Firstly, sociocognitive terminology is in opposition to the onomasiological view, and agues in favor of a semasiological view, meaning that priority is not ultimately given to the concept, but rather to the social environment from where concepts emerge. Therefore concepts are defined by how they are used to address particular phenomena or objects. Furthermore concepts are not always clear cut and exclusive, and there may not be a sharp demarcation between concepts and categories.

Secondly, sociocognitive terminology sees language as functional and ascribes it an active role in the formation, conception and communication of concepts and categories. There is more to language than its naming function.

Thirdly, sociocognitive terminology promotes a diachronic perspective on concepts and categories. Concepts and categories evolve as the result of social praxis, and terms and concepts eventually change their meaning.

The "classic" view of terminology is abandoned with reference to empirical evidence provided by studies of how terminology is used within different scholarly communities. Inspired by the work of George Lakoff and Mark Johnson (Lakoff, 1987; Lakoff &

Johnson, 1980, 1999), the socio-cognitive terminology demonstrates the classical view's shortcomings by empirical investigations of concepts in biotechnology.
The socio-cognitive view is at odds with cognitive science, see (Lakoff, 1987; Lakoff & Johnson, 1999), and stresses the importance of discourse communities as fundamental bases for concepts and categories. The meaning of language depends on social and cultural context, and involves experiential interaction and communication with others. The meaning of concepts is thus negotiated within the context of a discourse community. The sociocognitive view promotes a methodology for concept analysis that reflects how terminology is used within discourse communities, opposing the normative and functionalist role of classic terminology that in its aim for standardization imply how terms should be used in order to ensure consistency and communicative economy.
The discussion of objectivist versus socio-cognitive terminology is important because of their different emphasis on language. Objectivist terminology, as formulated by Wüster, disregards actual language as important in concept formation. The meaning of concepts is considered independent of expression. Consequently, objectivist terminology is only concerned with its naming function. The socio-cognitive approach takes the opposite approach and argues for the importance of social and communicative processes in concept formation.

2.4 KOS from a semeiotic perspective

From a semeiotic view, any representation is a sign. A sign is something that refers to another (a second), i.e. an object, and in between, a relation of interpretation (a third) that creates a more developed sign in a perceiving mind. C.S. Peirce defines the notion of a sign in the following quotation:

> *A sign, or representamen, is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is, creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object [or referent]. It stands for*

> *that object, not in all respects, but in reference to a sort of idea, which I have sometimes called the ground of the representamen (CP 2.228)*

Peirce's semeiotic theory will be discussed in detail later; for now it is sufficient to use Peirce's definition to establish that representations are considered signs, and signs have a reference and a meaning to an interpreter. What motivates a particular interpretation is, however, essential.

Hjørland considers KOS as semantic tools, and argues that different approaches to KO imply different approaches to semantics. For instance, the principle of literary warrant locates semantic relations in scientific and scholarly literature, and bibliometrics consider documents semantically related by means of citations (Hjørland, 2007b). Small (1978) and Schneider (2006) suggest that highly cited documents develop into concept symbols (or rather metonyms), meaning that a document by receiving citations, grow into representing particular ideas or meanings.

Semeiotic offers a theoretically and practically oriented view that embraces a wide perspective on knowledge, and suggests that knowledge production takes place in every part of society, being deeply tied to the social activities, thus establishing the common ground for conceptual meaning and communication. The meaning of a concept should therefore be considered in relation to its function and purpose defined within a universe of discourse, and cannot be separated from this context without loss of information.

The meaning of a sign relation is produced by the interpretant. The interpretant mediates between a sign (a representamen) and an object. However, a further elaboration on the function of the interpretant suggests that the interpretant functions at different conceptual levels: 1) the level of signification, 2) the level of cognition and 3) the level of communication.

KOS thus organizes concepts in a structure that at the first level, studies the relation of concepts to concepts, or signs to signs (the general conditions of signs being signs (grammar) (CP 1.444)).

> *Something becomes a sign not because of any inherent feature it has but because it acquires the formal characteristics that any sign must have, namely, that it correlate with an object and that it produce an interpretant*

> *in a process in which the three are irreducibly connected (Liszka, 1996, p. 19).*

The second level studies the formal conditions of the truth of representation (critical logic). Critical logic is concerned with valid inferences. According to Peirce, the logic of induction, deduction and abduction are principal to reasoning. Induction relates to experience or observation of facts (probability), deduction to the necessary consequences that follows from premises (necessecity), and abduction to the forming of hypothesis (possibility).

The third level studies the formal conditions of inquiry, and is considered the formal study of rhetoric or communication. Defining concepts as signs thus implicate grammar, logic and rhetoric, and the formal features of signification, cognition/inference and communication.

The level of signification	**The level of cognition**	**The level of communication**
Syntax	Logic	Pragmatics
Grammar	Denotation	Connotation
Form	Substance	Use
Word	Concept	Context

Table 3: Three conceptual levels of the interpretant

The first level (syntax) determines the nature of representations, i.e. how signs are signs of something. E.g. how a substantive is considered a term/a lexeme that stands for an object/concept. The level of cognition determines the meaning of a sign being a concept. It implicates a reasoning capacity that connects the level of signification with a determinate meaning. The third level determines how the sign acts as a communicator of meaning in a community.

The structure of table 3 resembles the interdependent dimensions of language described in table 1. This is no coincidence, because Morris developed his distinctions based in Peirce conceptual levels of the interpretant. From the perspective of semeiotic, however, the conceptual levels of the interpretant is itself triadic.

2.5 Summary

What have we learned from this presentation of KOS?

- That KOS are systems designed in order to provide order in a chaotic world of concepts
- That KOS are tools that are helpful in providing intellectual access to information sources
- That KOS are systems of representation
- That KOS are systems that depend on reasoning and language
- That KOS fundamentally are influenced by language and perspective
- That different approaches to KO require different semantic approaches
- That concepts are semantic units that require an interpretive effort
- That the interpretive effort is a semeiotic activity
- That KOS accordingly can be addressed from a semeiotic perspective

KO is considered a subfield within the LIS community. It is concerned with theories and methods for organizing knowledge. KOS's are generally speaking semantic systems whose function is to represent and structure knowledge for somebody. The knowledge structure provided by KOS's, are based on semantic units, i.e. concepts, classes or signs/symbols. It has been argued that the traditional kinds of KOS may be regarded as variants of each other, but with a different focus on semantic relations. However, the traditional types of KOS ignore the social and cultural aspects of concepts, and tend to favor logical decomposition as governing principle in KOS design.

The related approaches, Ontology and KR, which may include the traditional types of KOS, are closely related to AI and computer linguistics and, thus, formal language representation. As a consequence, these approaches, when integrated in KOS, contribute with a high level of formal structure, well suited for computation.

The function of this chapter has been to demonstrate that the mentioned kinds of KOS share a similar purpose, namely in being systems that organize words, concepts and categories. It is also indicated by Hodge's taxonomy and more elaborate by table 2 that

the different KOS, from term lists to ontologies, also express an increase in formal semantics. Even though term lists are normative, determining the 'preferred' labels for concepts, it is only at the level of semantic networks and ontologies, we may speak of computation. The aim has also been to point out that the semantic relations of concepts also implicate a pragmatic dimension, which often is disregarded in KO.

So far, the discussions of KOS have departed from the perspective of representation and systematization of semantic units. The remaining part of the dissertation will focus on the value of incorporating the pragmatic dimension, in terms of communication, as guiding principle in relation to KOS development.

The focus of the next chapter thus adds language, communication and meaning to the picture, and demonstrates why theories of concepts, philosophy of language and meaning are important perspectives on KOS.

3 Concepts, Language and Organization of Knowledge

Introduction

The purpose of this chapter is to determine the consequences of different approaches to concept theory. Based on Ereshefsky's division (Ereshefsky, 2001), the discussion of concepts are divided into essentialism, cluster analysis and the historical approach. Essentialism is according to Ereshefsky associated with rationalism and empiricism, and traces back to Plato and Aristotle. Generally, essentialism can be characterized as the doctrine that objects have essential and accidental properties. Essential properties are necessary properties that objects have; in contrast, accidental properties are properties that objects of a particular kind may lack. The classical theory of categorization follows form the essentialist claims that a category is defined by a given property or collection of properties which are necessary and sufficient to define the category.

The discussion of the cluster analytical approach involves a family of theories, including Kuhn's concept theory (H. Andersen, 1997; H. Andersen, Barker, & Chen, 1996; Kuhn, 1990), and Wittgenstein's theory of language games. Also the theory of cognitive semantics formulated by George Lakoff is related to cluster analysis. Cluster analysis is considered less restrictive (weak model of representation) than essentialism; no traits are considered either necessary or sufficient for category membership.

The historical approach contrasts the theories formulated under essentialism and cluster analysis by emphasizing the aspects of evolution, continuity and causality.

> *The historical approach reverses the roles of qualitative similarity and causal relations: Causal relations are primary and qualitative similarity is important only when it serves as evidence for causal relations. (Ereshefsky, 2001, p. 28-29)*

It is argued that KOS mostly are related to strong models of representation (Tredinnick, 2006), i.e. essentialism, and that contemporary KOS as ontologies and semantic networks are deeply rooted in strong models of representation. The cognitive semantic approach argues that language and concepts fundamentally are embodied and their meaning determined by culture and experience. Cognitive semantics is thus in opposition to essentialism, and introduces the term 'experientialism' and 'embodied realism'. It is argued that cognitive semantics provides for new insights when considered in relation to KO and KOS, however, cognitive semantics is unclear when it comes to the concepts of evolution, continuity and causality.

It is argued that Peirce's semeiotic theory embraces the historical approach, and in particular is sensitive to the evolution, continuity and causality of scientific knowledge.

The chapter is concluded by a section that relates the different approaches of concept theory to KO.

3.1 Concept theory

As discussed in the previous chapter, KOS's are systems that represent semantic units, and as such the function of KOS is to organize documents (shelving), representations of documents (bibliographical records) and concepts (subjects).

Concepts are in particular important, because concepts relate to subjects and thus to indexing and classification.

To classify is to arrange particular objects into categories according to general features or properties. However, how is the pertinence of features determined? Which criteria should be applied in order to organize similar objects into the same category? What is the epistemological status of a class? And what is exactly meant by similarity, subjective / objective similarity or descriptive / analytical similarity?

Generally speaking, classification of objects is a fundamental biological and socially determined activity that enables humans to act, adapt and survive in the surrounding environment. One of the most basic classifications learned by the human child is the ego / non-ego distinction. A similar kind of basic classification is to distinguish between e.g. edible and poisonous, or between friend and enemy. It is within the human nature to

classify the objects of the world. This may be regarded as common sense, however, the rationale of human intelligence provides for actions that rest on the ability to recognize features of objects in the world and to organize experiences into purposeful categories in order to survive. The human species alone has developed language, which enables humans to address and communicate experiences by means of conventionalized symbols. The big philosophical problem, however, is related to the determination of the status of concepts and language. In other words, in what way do our concepts actually correspond to objects in the world?

Within science, classifications of objects are based on theories (and concepts). Different theories provide for different methods for investigating and classifying objects of interest. Empiricism gives priority to experience; knowledge is considered a posteriori, and our concepts about the surrounding world are therefore derived from experience. In the philosophy of science, rationalism is considered the logical opposite of empiricism and gives priority to reason and a priori concepts.

Within philosophy, the problems concerning the relation between concepts, classification and the world itself can be traced back to Plato and Aristotle[20].

In (Ereshefsky, 2001) the problem of scientific classification is related to three general philosophical schools: essentialism, cluster analysis and historical classification.

According to Ereshefsky, essentialism represents traditional concept theory originating from Plato and Aristotle. The essentialism of Plato and Aristotle are different in nature; Plato divides the universe into the essential universe, which is perfect, and the perceived universe, which is the imperfect reality. For Plato, the essential universe is real and the perceived reality less real. Thus, the identity of a creature is therefore defined by its essential and perfect features. The variation of actual exemplars of a kind is part of the perceived reality; however, the exemplar of a kind would contain essential features that are the same for all exemplars of a kind. This division between an essential and perceived reality provides for Plato's dualist distinction between form and matter. This distinction is fundamental in Plato's metaphysics (Robinson, 2006).

Aristotle argued against Plato's distinction between form and matter; according to Aristotle, the properties (or essence) of things do not relate to a distinct and separate

universe of ideas, but is an essential part of the thing itself. Accordingly, forms, or ideas, do not exist independently of their instances.

Both Plato and Aristotle promoted a realist epistemology. However, in modern philosophy one may interpret Plato's metaphysics as a kind of idealism related to rationalist epistemology - knowledge of reality derives from the intellect and not the senses, and thus resembles the epistemology promoted much later by Descartes (Newman, 2005).

According to Aristotle, real essences are powers or functions which are embodied in matter, but they are not material, but pure form (Ereshefsky, 2001). Aristotle's metaphysics may from a modern philosophical perspective be considered as a kind of materialism and related to empiricist epistemology. Furthermore, Aristotle seems to combine both rationalism and empiricism in his philosophy. Concepts are defined rationally, by necessary and sufficient conditions, but they do not exist independently of actual entities. Aristotle may also be considered functionalist, by conceiving real essences as teleological functions. Powers are considered means to achieve ends. Aristotle thus inhabit evolution and pragmatism in his philosophy. These aspects of Aristotle was acknowledged by the American psychologist and philosopher William James (1842-1910), who admitted that pragmatism is no more than "*A New Name for Some Old Ways of Thinking*" (James, 1907) with a clear reference to Aristotle's teleology.

Cluster-analysis[21], or cluster concepts, on the other hand, as defined by Ereshefsky (ibid.), covers a wide range of theories about the status and formation of language and subsequently the definition of concepts.

> *All forms of cluster analysis make two common assumptions: the members of a taxonomic group must share a cluster of similar traits, and those traits need not occur in all and only the members of a group. Still, cluster analyses vary: first, on the breath of similarities desired among the members of a taxonomic group, and second, on the relationship between similarity and theory (Ereshefsky, 2001, p. 24).*

One common aspect of the theories that are defined as cluster-analysis is that they argue against the classical definition of classes and concepts as defined by Aristotle. Particular entities of the world may fit poorly into a class defined by necessary and sufficient conditions. The Austrian philosopher Ludwig Wittgenstein (1889-1951), demonstrated this in his '*Philosophische Untersuchungen'* (Wittgenstein, 1958), by his example of games, that the particulars of a category may show what Wittgenstein labeled family resemblance rather than meeting a set of essential features defined by a particular concept.

A fundamental concept in cluster analysis is 'similarity' or 'resemblance', but in graded rather than absolute form.

In biology, the concept 'phenetics' or 'numerical taxonomy' signify the idea of grouping species by shared characteristics.

> *The basic pheneticist idea is to identify species, and higher taxa, by investigating a very large number of phenotypic traits, and constructing a measure of the "overall similarity" of any two organisms, based on how many of these traits they share. Species are then defined as the largest groupings whose members bear a certain minimum degree of overall similarity to each others. (Okasha, 2002, p. 199)*

However as pointed out by (Ereshefsky, 2001; Lakoff, 1987; Okasha, 2002) which properties should be determined valid as a shared characteristic and which should be ignored? Which kind of criteria can provide for an objective classification of species?

> *The major problem with pheneticism is that by weighting traits differently, different measures of "overall similarity" can be constructed, leading to incompatible taxonomies. (ibid, p. 199)*

The shared overall similarities that provide for the intension of a particular kind resembles essentialism as discussed above, however according to Ereshefsky (2001), no traits are considered either necessary or sufficient for membership of a category, and therefore phenecism is less restrictive than essentialism.

Several other approaches give priority to even less restrictive ideas of concepts and categorization. Within linguistics, the cognitive semantics provides for a philosophy of prototypes (Lakoff, 1987). A concept is within this perspective defined by an example or a prototype, meaning that an object is an instance of a concept, not by virtue of meeting the necessary and sufficient conditions of the concept, but by resemblance with a prototype. An object is an instance of a concept C if it resembles the characteristics of prototype 'C' more closely than the prototypes of concepts other than C. Furthermore, prototypes are considered culturally relative.

Temmerman (2000), takes the idea of cognitive semantics into the study of terminology and argues in favor of a new paradigm in terminology labeled socio-cognitive terminology. As is the case with cognitive semantics, cognitive terminology considers knowledge to be experiential, meaning that what we know and understand about the world ultimately is the result of sensory perceptions. Furthermore, language plays an active part in our conception of the world. Language is considered a means for categorization (Temmerman, 1997).

On the basis of empirical investigations of concepts, within the field of life science, Temmerman provides a serious critique of the dominating objectivist paradigm within terminology and essentialist classification.

Temmerman summarizes the critique of the principles of objectivist terminology in the following table:

Principles of traditional Terminology	**Our observations concerning the terminology of special language**
First principle: Terminology starts from the concept without considering language.	Language plays a role in conception and communication of categories
Second principle: a concept is clear-cut and can be assigned a place in a logically or ontologically structured concept system.	Many categories are fuzzy and cannot be absolutely classified by logical and ontological means.
Third principle: a concept is ideally defined in an intensional definition	An intensional definition is often neither possible nor desirable

Fourth principle: A concept is referred to by one term and one term only designates one concept	Polysemy, synonymy and figurative language occur and are functional in special language
Fifth principle: the assignment concept/term is permanent	Categories evolve, terms change in meaning, understanding develops.

Table 4: Traditional vs. socio-cogntive terminology. (Temmerman, 2000, p. 16), provides an overview of the main differences between the traditional terminology school and the contemporary socio-cognitive paradigm.

The traditional terminology paradigm, as formulated by Wüster, is in line with essentialism and rationalism which defines concepts as clear-cut and permanently structured within a concept-system. It is considered objective and final.

The paradigm advocated by Temmerman is in line with cluster-analysis, and gives priority to empirical occurrences as point of departure for defining concepts and categories. Concepts are not considered clear-cut, because investigations of language used within particular discourse communities, show that categories are graded, and should for that reason not be forced into a fixed and formalized structures. Consequently, socio-cognitive terminology considers concepts as dynamical, inconclusive and (inter)subjective.

As we may see, the conflict between the two paradigms is grounded in the classical philosophical dichotomy between rationalism and empiricism. Should priority be given to reason and logical subdivision and eventually universality, or should priority be given to empiricist epistemology, which rejects universal a priori knowledge, replacing it with experientialism. The socio-cognitive view concludes that the meaning of concepts is manifested by their actual use within different contexts and communities, and opposes a normative essentialist view that aims at defining the right meaning and use of concepts.

According to the American physicist and philosopher of science, Thomas Kuhn (1922-1996), scientific knowledge is organized around a paradigm. A paradigm may be thought of as a complex system of social interests, values and practices that constitutes a discourse community. According to Kuhn, the history of science shows that scientific knowledge is based on assumptions about the world that may be fundamentally changed

by new and future assumptions or theories. Kuhn introduces the concept of normal science which is the state where the scientific paradigm within a community is stable and undisputed. A crisis may occur as a result of discrepancies between theory and fact, which may provide for the emergence of new or alternative scientific theories. The crisis provided by anomalies may eventually result in a change of paradigm, a scientific revolution that in the end will establish alternative fundamental assumptions about the world and eventually provide for a new period of normal science. According to Kuhn, the change between stages of normal science, crisis and revolution, followed by the emergence of a new stage of normal science, constitutes the life-cycle of a paradigm. However, the normal science state that comes out of a scientific revolution is considered incommensurable with the old paradigm. Kuhn believes that science is a form of puzzle solving within a paradigm. A new paradigm provides new puzzles, but the theoretical commitments of a paradigm also provides for new anomalies, so the puzzle will never be complete.

The meaning communicated by scientific concepts is thus relative to a particular domain of knowledge. Concepts that seem alike may be defined and contextualized differently by different knowledge domains. Similar concepts can exist in different knowledge domains, but with different influential values and meanings.

The meaning of scientific concepts is therefore complex and depends on how they are used to address particular research interests within a discursive framework.

Kuhn regarded scientific knowledge as the product of social interaction. Kuhn dismisses the continuity of science. Truth is relative to a paradigm, what counts as true knowledge in one paradigm is different from what counts as true knowledge in a different paradigm. In other words truth does not transcend a scientific revolution.

The British philosopher Roy Bhaskar (1991) relates Kuhn's notion of paradigmatic incommensurability to what he names critical realism. Kuhn stresses that 'though the world does not change with a change of paradigm, the scientist afterward works in a different world' (Kuhn, 1974, p. 121).

> *once we disambiguate 'the world' into 'social, historical, transitive' and 'natural, (relatively) unchanging intransitive' we can transcribe the*

> *sentence, without paradox, as: 'Though the (natural (or object)) world does not change with a change of paradigm, the scientist afterward works in a different (social or (cognitive)) world. (Bhaskar, 1991, p. 10)*

Bhaskar saves Kuhn from total relativism by relating 'the natural world' to the domain of the intransitive and 'the social world' to the domain of the transitive. In other words, there may be an external world that is relatively enduring and independent of human perception, but cognition depends on perception, and thus our concepts about the world are fallible and only likely (transitive). Failure to recognize this division between reality and observed reality, thus confusing statements about being (ontological statements) and statements about knowledge of being (epistemological statements) leads to an epistemic fallacy. As a consequence, Bhaskar argues that Kuhn's paradigm theory imply metaphysical realism, but epistemological pluralism.

As discussed by (H. Andersen, 1997), Kuhn's account of scientific concepts is clearly inspired by Wittgenstein. However, Kuhn's account of family resemblance extents Wittgenstein's theory by including dissimilarity as an essential and decisive aspect among instances of a concept.

Furthermore, Kuhn claimed that scientific practice is based on 'exemplary solutions' that sets the standard for future research. These 'exemplary solutions' supply the novice with basic scientific concepts. Concepts are thus closely related to a particular kind of practice of doing science. And the meaning of concepts are thus internalized and learned through practice. Kuhn thus clearly bases his theory of concepts in constructivist epistemology.

The cluster-analytical tradition provides for graded categories, because concepts are defined by resemblance between instances. However, as argued by Andersen (1997), we can always find some relations between particular objects, and the problem thus becomes a problem of infinite regress. How do we determine important similarities from less important ones? How do we specify the relevant similarity properties apart from the irrelevant, without reproducing the essentialist account of concepts?

Kuhn tries to solve the problem of under-determination by providing an account of conceptual structure that is not only determined by similarity, but also includes dissimilarity and contrast sets.

> *…it is an essential part of Kuhn's philosophy of science that, on the background of some adopted classification, a new object may be encountered which judged from some features is an instance of one concept, but judged from other features is an instance of a contrasting concept. In such a situation, people using these different features in judging similarity and dissimilarity will ascribe the new object to contrasting categories. However although they may categorize the object differently, they still agree that they cannot all simultaneously be correct. (H. Andersen, 1997, p. 97)*

Membership of a particular category thus depends on what features are endorsed by a particular scientific theory, or in other words, what paradigmatic viewpoint that is considered to be correct. Therefore dissimilarity is as important as similarity for a particular classification.

In many ways the cluster-analytic tradition as described in Ereshefsky (2001), promotes an anti-realist epistemology where language, culture and embodied activity constitute the epistemic threshold for how knowledge about the world can be achieved.

The historical approach to concept formation deviates from the essentialist and cluster-analytic traditions by prioritizing causal relations opposed to essential qualities and similarity.

In Ereshefsky (2001), the historical approach is considered based on evolutionary principles. A member of a category is a member not by virtue of qualities, but because of causal relations that are unique for a particular species.

> *…humans, for example, should be sorted into the species Homo sapiens not because they look alike, but because all humans form an uninterrupted and unique causal sequence of organisms. (Ereshefsky, 2001, p. 29)*

If we want to know why particular species has particular features, organs, abilities, etc. we need to unravel the historical and evolutionary conditions that has made these abilities feasible. Instead of describing the qualities that distinguish natural kinds by

similarity and differences, the historical approach seeks a deeper explanation of the qualities that are manifest in a particular kind.

Even though the historical approach is considered from the perspective of biology, the perspective of genealogy and evolution is not exclusively related to biology, but has been considered by philosophers within other scientific areas, such as human history, sociology, classification, systems analysis and linguistics.

The historical approach is concerned with the origins of a class, its environment, its theoretical foundation, its relation to historical facts, etc. The historical approach may thus be considered more context sensitive than the essentialist and cluster-analytical approach.

The concept of 'historical approach', however, includes several different viewpoints that seem incommensurable. The historical approach e.g. includes discourse analysis, critical theory, and culture studies; and concepts and categories are considered part of society and formed by human activity within culture and society. Knowledge structures thus emerge as consequences of social activity; and knowledge structures, including concepts and categories, are closely tied to the activities conducted within discourses (J. Andersen & Skouvig, 2006).

Ereshefsky's exposition of the three philosophical schools of concept theory, thus divides concept theory in to objectivist, socio-cognitive and discursive epistemologies.

3.2 Philosophy of language and Concept Theory

Linguistic theory has been heavily influenced by the philosophy of language that traditionally is concerned with logic, meaning and sense making, i.e. true and false statements, in relation to the real world, and can be traced back to the British empiricist John Locke and his ideational theory of meaning (Malmkjær, 1996), see also (Grayling, 1997). Further influential theories in linguistics are: logical positivism, often mentioned by reference to the Vienna Circle[22], which was concerned with correspondence theory and verification of meaning between concepts and objects in the world in order to establish absolute truth. In relation to the Vienna Circle the most influential person was

Rudolph Carnap[23], but also the young Wittgenstein's "Tractatus Logico-philosopicus" was of major influence.

Austin's speech act theory (Austin, 1971; Searle, 1971), has been a valuable contribution in the philosophy of language, and is seen as a direct reaction against logic positivism.

> *Austin points out that there are many declarative sentences which do not describe, report, or state anything, and of which it makes no sense to ask whether they are true or false. (Malmkjær 1996, p. 416)*

Searle develops the notion of speech acts further (Searle, 1969), and identifies four major types of speech acts: utterance acts, propositional acts, illocutionary acts, and perlocutionary acts. These four types of speech acts are used as tools for analyzing the structure and types of communication in language use. What is of special interest is the aspect of act, or action, where communication is seen as a tool for achieving something.

Other important theories in the philosophy of language is the structuralist linguistics rooted in Ferdinand de Saussure's (1857-1913) semiology, see (Saussure 2000); and generative grammar developed by Noam Chomsky, see (Chomsky, 1975).

Saussure's linguistic semiology has been significantly influential in semiotics, and is often referred to as the European tradition in semiotics, which also incorporates Louis Hjelmslev (1899-1966), Jacques Derrida (b. 1930) and Roman Jacobsen (1896-1982). The object of Saussure's semiology was to describe socially determined signs, the systems, which they form, the rules governing their use, and their evolution in time. Signs are fundamental constructs and products of social communication. The meaning of signs is derived and conventionalized from this social activity. The structuralist perspective was in opposition to the traditional philosophy of language, which main concern was absolute truth, disregarding language, culture and social conventions. The structuralist perspective rejects the notion of transcendental ideas, existing independently of language and cultural codes. Concepts exist only within a certain structure of meaning which is anchored in human culture and activity (Sebeok, 1994).

Chomsky's generative grammar is concerned with the deep structure of language and considers the utterance of language as mere surface structure.

Chomsky's theory represents a rationalistic and cognitive approach to language; the deep structure is rooted in the human brain and is universal for all languages. The generative grammar is conceived as the set of rules that defines the unlimited number of sentences of the language and associates each with an appropriate grammatical description (Malmkjær 1996). However, even though Chomsky is concerned with the structure of language, it is not to be confused with the linguistic structuralist sense. Chomsky's theory of generative grammar is controversial, but has been valuable in relation to the development of software systems, e.g. automatic translator systems and expert systems in computer science.

3.2.1 Cognitive linguistics

Recent studies in cognitive semantics and cognitive linguistics apply experientialism to categorization (Lakoff, 1987; Lakoff & Johnson, 1980, 1999; Lakoff & Núñez, 2000) and mark a significant turning point in linguistic theory. The meaning of language is not related to objective categories in the world, or to internal formal syntax of grammar. Cognitive semantics breaks fundamentally with the objectivistic tradition. It is an epistemology about man and man's understanding of himself and the surrounding world as well as man's interaction with the surrounding world. Cognitive semantics breaks with traditional linguistic theories, which has its theoretical background in logic and cognitivism. Furthermore, cognitive semantics breaks with the idea that the *syntax* is the staple and decisive level for meaning - and thus with the generative grammar of Chomsky that started the research into the connection between language and cognition. Cognitive semantics claims about semantics that the content in language has to do with cognitive problems, not logical ones alone (Lakoff 1987; Lakoff and Johnson 1999).

> *On the traditional view, reason is abstract and disembodied. On the new view, reason has a bodily basis. The traditional view sees reason as literal, as primary about propositions that can be objectively either true or false. The new view takes imaginative aspects of reason – metaphor,*

> *metonymy, and mental imagery – as central to reason, rather than a peripheral and inconsequential adjunct to the literal. (Lakoff 1987, p. xi)*

Lakoff shows, that concepts and categories are developed according to cognitive models and prototypes; meaning that the categorizations made by language depends on how it is used in communities. Categories are not clear cut, but show prototypic features, e.g. in the category of birds, the sparrow is more prototypical than e.g. an ostrich. As discussed later, scientific categorization is also explanation based and thereby not objective (Bryant 2000). The concepts of basic level categorization, prototypes and cognitive models will be addressed in the following sections.
The fundamental assumptions of cognitive semantics or cognitive linguistics may be summarized by the following three statements:

- Language is not an autonomous cognitive faculty
- Grammar is conceptualization
- Knowledge of language emerges from language use
  (Croft & Cruse, 2004, p. 1)

The hypotheses clearly oppose to objectivist theories of language and cognition. and thus to objective concepts and categories. Cognition cannot be separated from language, as suggested by the generative grammar.
Grammar itself is conceptualization, and not objective symbol manipulation. There is no reason to believe that linguistic knowledge is different from knowledge based in other cognitive tasks such as visual perception and motor activity (Croft & Cruse, 2004).
Furthermore knowledge emanates from language use. Thus, the meaning of language is related to praxis and context.

3.2.1 Basic-Level Categorization

When an indexer describes a document by means of subject indicators what does this representation actually express? A subjective (the indexers) interpretation of what the

document is about? Or is some kind of objectivity assumed, based on the KOS or the users of the domain? Or does it express the intentions of the author of the document?

These are questions of aboutness, considered within the research of KO and IR. Aboutness is a complicated concept (and will not be discussed in detail here, see e.g. (Ingwersen, 1992), that may be related to different perspectives and conceptual levels within the indexing process. It is difficult to state objectively what a document is about; one should maybe, as discussed by Hjørland (1997), rather ask what functions or interests the document is thought to fulfil within a particular community.

Furthermore, subject indicators are always assigned in relation to something else. This 'else', or the relation the indexer creates between concepts and documents, is a manifestation of what Lakoff refers to as a confluence of gestalt perception, the capacity for bodily movement, and the ability to form rich mental images.

That is, a subject indicator communicates a particular meaning from one structure (i.e., a KOS) to another structure (a document), and thus establishes a connection.

A similar situation appears in the information searching process where the user may agree to the suggested relations between subject indicators and documents.

Basic level categorization relates cognitive models and prototypes to meaning making, and deviates from the classical Aristotelian concept theory. Additionally, basic level categorization establishes a hierarchical structure or organization of concepts by addressing their cognitive function. Basic level categorization is characterized by the following features:

> *(1) It is the most inclusive level at which there are characteristic patterns of behavioral interaction.*
> *(2) The most inclusive level for which a clear visual image can be formed.*
> *(3) The most inclusive level at which part-whole information is represented.*
> *(4) The level used for everyday neutral reference.*
> *(5) Individual items are more rapidly categorized as members of basic level categories than as members of superordinate or subordinate categories.*
>
> *(Croft & Cruse, 2004, p. 85)*

Furthermore, basic level categorization is

- The highest level at which category members have similarly perceived overall shapes;
- The highest level at which a single mental image can reflect the entire category;
- The highest level at which a person uses similar motor actions for interacting with category members;
- The level at which subjects are fastest at identifying category members;
- The level with the most commonly used labels for category members;
- The first level named and understood by children;
- The first level to enter the lexicon of a language;
- The level with the shortest primary lexemes;
- The level at which terms are used in neutral context. For example, 'There's a dog on the porch' can be used in a neutral context, whereas special contexts are needed for 'There's a mammal on the porch', or 'There's a wire-haired terrier on the porch'.
- The level at which most of our knowledge is organized

(Lakoff, 1987, p. 46)

If we consider the concepts 'dog' and 'chair' it is obvious that they fit the above-mentioned definition of basic level categories, while concepts such as 'mammal' and 'furniture' do not; we are for instance not able to imagine single mental images that represent the superordinate categories. 'Furniture' is too abstract and requires several mental images, while also requiring different motor movements.

According to Lakoff, the superordinate category does not provide for additional information in relation to the basic level category.

The subordinate level provides for more specialized information. A chair can be of a particular kind, for instance a rocking chair; however, the motor movement involved 'sitting in a chair' remains the same. The way in which we interact with objects (i.e.

chairs, tables, beds etc.) is conditional to certain motormovements. We do not (strictly speaking) use a bed as a table or a chair as a bed. Each kind of furniture prescribes a sequence of different body movements.

> *When performing the action of sitting down on a chair, a sequence of body and muscle movements are typically made that are inseparable from the nature of the attributes of chairs — legs, seat, back etc. (Rosch, 1978, p. 33)*

Rosch made some tests where she had a person describe as detailed as possible which motor movements she made when she sat down in a chair. Rosch writes:

> *There are few motor programs we carry out to items of furniture in general and several specific motor programs carried out in regard to sitting down on chairs, but we sit on kitchen and living room chairs using essentially the same motor programs. (ibid, p. 33)*

This is a solid argument for the fact that the large amount of common qualities do not emanate from the categorized objects, but from the categorization and interaction with them.
On this basis we may argue that basic level categorization infuse our ways of action in relation to our life world, both bodily and intellectually.

> *The fact that knowledge is mainly organized at the basic level is determined in the following way: When subjects are asked to list attributes of categories, they list very few attributes of category members at the superordinate level (furniture, vehicle, mammal); they list most of what they know at the basic level (chair, car, dog); and at the subordinate level (rocking chair, sports car, retriever) there is virtually no increase in knowledge over the basic level. (Lakoff, 1987, p. 47)*

Again Lakoff makes an important observation. All human beings are equipped with the same cognitive apparatus, however, the surrounding world decides the basic level in the

sense that the surroundings are decisive for what a culture defines as basic. A sealer or a whaler has other basic level categories than e.g. a farmer.

Researchers from different knowledge domains have a different basic-level understanding of similar concepts. Thus the concept 'model' is used and understood differently in the various knowledge domains. Even within the same knowledge domain there can be differences in the understanding of the same concepts — we could call it different 'dialects'. The intentionality is cognitively tied to a life-world and not only to the context of the concept. This should be understood in the way that the intentionality is also part of the knowledge domain into which the concept is weaved and from which it gets its meaning. On the other hand, it is the intention and the preunderstanding of the user, the user's domain knowledge, and the information need of the user, that form the decisive part in how the user understands the concept.

From the perspective of KO, we may argue, on the basis of the insight provided by cognitive semantics, that a vocabulary or classification system based on basic level concept and categories may be useful for users.

Furthermore, the mechanism of basic level categorization is considered to apply to abstract concepts. However, the concept of mental images, as e.g. the basic level of 'dog' is different, because there may not exist an ostensive object that provides for a suitable image. The 'image' may instead be a collection of experiences associated with the particular object, e.g. the origins of the concept, the context where it acquires its meaning, how it is related to theory, methods and models, etc. Unravelling the deeper meaning of an abstract concept may thus benefit from a historical approach to concept analysis.

3.2.2 Cue validity

Cue validity is a measure of conditional probability. Instead of necessary and sufficient conditions for membership of a category, membership may be established given the existence of particular features or cues.

> *Cue validity is a probabilistic concept; the validity of a given cue x as a predictor of a given category y (the conditional probability of y/x)*

> *increases as the frequency with which cue x is associated with category y increases and decreases as the frequency with which cue x is associated with categories other than y increases. The cue validity of an entire category may be defined as the summation of the cue validities for that category of each of the attributes of the category. A category with high cue validity is, by definition, more differentiated from other categories than one of lower cue validity. (Rosch, 1978, p. 30-31)*

Some cues may be more unique for a category than others, e.g. gills has a high cue validity for the category fish, lungs on the contrary has a low cue validity.
According to Rosch, the highest cue validity within taxonomy would occur on the basic level category. Cue validity on a superordinate level would be low because the superordinate level includes many different objects that have few or no common attributes. Similarly on the subordinate level cue validity would also be low, because the particular kind of the basic level category differentiates it from other kinds within the same basic level category.

3.2.3 Prototypes

The classical model of conceptual categories is exclusive and defined by necessary and sufficient conditions. Meaning: A particular object can only be a member of one class, and membership is defined by a set of necessary and sufficient features that are defined by the class intension. *Necessary* means that an object must possess a full set of the class attributes to be a member, and, furthermore, *sufficient* means that possession of all the features of class attributes guarantees membership.
However, the classical definition of concepts is faced with several difficulties:

> *The difficulties faced by the classical model of conceptual categories are many. Three frequently cited shortcomings have provided the major motivation for the development of alternative theories. Firstly, for many everyday concepts, as Wittgenstein pointed out with his well-known example of GAME, adequate definitions in terms of necessary and sufficient features are simply not available. Furthermore, as Fillmore*

> *(1975) pointed out in connection with the noun bachelor, even for those concepts that seem to have definitions, the definitions typically hold only within a specific domain […]. Secondly, what is here called 'graded centrality' constitutes a problem; that is, the fact that some members of a category are judged 'better', or 'more representative' of the category than others: in a classical category, all members are equal. Thirdly, the classical model can offer no account of why category boundaries, in practice, seem to be vague and variable. (Cruse, 2004, p. 76-77)*

During her research, Eleanor Rosch introduced the concept 'prototype effect', the fact that some representatives, members, things, animals, etc. are more typical for their class than others. The blackbird is considered more prototypical for the class of birds than the ostrich or the penguin. Rosch, however, rapidly abandoned the idea that categories, generally speaking, are organized from a prototype, and the other elements of the class graduate accordingly after this prototype. Prototype effect is, according to Rosch and Lakoff, no basic quality of the categories, but prototypicality is a sign of categorization.
Considering the example of 'dog', the concept 'dog' denotes a prototypical gestalt that contains all empirically experienced dogs, but it does not exist empirically in itself. Thereby the prototypicality has become a sign of categorization.
In the previous section, the first part of Lakoff's embodiment concept was introduced, including the key concepts 'basic-level categorization', 'cue-validity' and 'prototype effect'. The following section will explore the second part of Lakoff's embodiment concept. This part of the embodiment concept grants us knowledge about how we are able to transfer and intellectually understand the basic-level concepts.

3.2.4 Kinaesthetic image-schemas

The second part of the embodiment concept includes a theory about kinaesthetic image schemas, gestalt schemas through which the world is perceived, which again is defined through basic-level categories. Since basic-level concepts are grounded in embodiment, and the kinaesthetic image schemas are bodily understood and transferred through metaphors, metonymies, and radial structures, Lakoff's cognitive semantics takes a powerful biological turn, but it is not a matter Lakoff digs further into (see (Brier 1997)

for development of this aspect), yet, without interfering with biological matters, we shall adduce that it is through our senses that we receive the stimuli we categorize. In other words, the sense of smell is a cognitive mechanism that acts metonymically in the sense that a certain smell, scent, or aroma is able to evoke mental images of experiences tied to that particular scent. We also categorize things as something that smells nice, bad, unpleasant, and we react unconsciously on scents of the opposite sex etc. Our other senses are likewise. Lakoff writes:

> *Kinestetic image-schematic structure: Image schemas are relatively simple structures that constantly recur in our everyday bodily experience: CONTAINER-PATHS, LINKS, FORCES, BALANCE, and in various orientations and relations: UP-DOWN, FRONT-BACK, PART-WHOLE, CENTER-PERIPHERY, etc. (Lakoff, 1987, p. 267)*

This quotation contains a definition of the kinaesthetic image schemas, which is central in our understanding and organization of the surrounding world. As Stjernfelt writes:

> *These [kinestetic image schemas] play the role as pre-conceptual archetypes that can be used to comprehend more complicated and not fully understood phenomenological occurrences. They are generally of a spatial nature and concern the foundation of the biological organization of the body in space and time in its use of basic-level category objects. (Stjernfelt, 1992, p. 115) (translated from Danish)*

Put another way, we understand and conceptualize the phenomenological world by the way we move around in it. By means of kinaesthetic image schemas and basic-level concepts we categorize the world. Kinaesthetic image-schemas thus provide for a particular orientation, and that is strictly related to human cognition, it is an intellectual ability that intervenes in our understanding of the surrounding world.

Furthermore, it may be argued that if the kinestetic image schema is a cognitive ability that provides for orientation in the world it may also influence how knowledge systems are organized. The idea of ‘core concepts’ within a particular knowledge domain invoke the center-periphery distinction. The up-down distinction is operational within any

hierarchically organized KOS. Documents 'contain' information and are 'linked' by means of references. The part-whole distinction is important in thesaurus construction, here realized as narrow or broader concept relations.

3.2.5 Metaphors, metonymy, and radial structures

> *A standard dictionary definition describes a metaphor as 'a figure of speech in which a word or phrase literally denoting one kind of object is used in place of another to suggest a likeness between them'. Although the theoretical adequacy of this definition may be questioned, it conveys the standard view that there is a difference between literal and nonliteral language; that figurative speech is nonliteral language and that a metaphor is an instance of figurative speech. (Routledge, 2001)*

The function of the metaphor is to transfer meaning between two separated and un-related domains, e.g. by comparing features of one object to another.
Lakoff makes a distinction between what he labels 'conceptual metaphor' and a 'metaphorical expression'. By this distinction, the conceptual metaphor becomes the general form and metaphorical expressions the instantiation of the conceptual metaphor.

Conceptual metaphor:	Love is a journey
Metaphorical expressions:	This relationship is foundering,
	We are going nowhere,
	This relationship is a dead-end street, we are at a cross-roads,
	etc.

(Kertesz, 2004, p. 48)

From this perspective metaphors are not merely figurative speaking, or a matter of stylistics, but rather a genuine capacity for reasoning.

> *What constitutes the love is a journey metaphor is not any particular word or expression. It is the ontological mapping across conceptual domains, from the source domain of journeys to the target domain of love. The metaphor is not just a matter of language, but of thought and reason. The language is secondary. The mapping is primary, in that it sanctions the use of source domain language and inference patterns for target domain concepts. The mapping is conventional; that is, it is a fixed part of our conceptual system, one of our conventional ways of conceptualising love relationships. (Lakoff 1993, p. 208)*

Lakoff and Johnson (1980), understand the concept of the metaphor as a central tool for thought. Thinking is to depict parts of or structures from one mental space in another. The mental space Lakoff mentions is the ability to metaphorize, to transfer a perceived phenomenological world to cognitive structures through the kinaesthetic image schemas.

Furthermore, the reasoning mechanism of the metaphor may provide for new ways of perceiving the world, it may create new 'realities'. Metaphors provide structures, i.e. a certain way of perceiving objects or problem areas. It has the ability to focus on certain aspects and blur others.

Another important concept is metonymy. Like the metaphor, the metonymy possesses a mediating quality, which is to transfer meaning from a part to a whole, i.e. we can recognize the part in the whole, but also the whole in the part. Metonymy differs from the metaphor in that it does not blend different conceptual spaces. Another distinction is that metaphors operates on the basis of similarity, e.g. the similarity between 'Love' and 'Journey', where metonymy operate on the basis of association, e.g. by whole-part relation: an author may for example be used metonymically as a representation for the whole body of his work.

According to Cruse (2004), metonymy may be divided into 'intrinsic' associations, which are inherent and relatively constant, and 'extrinsic' associations, which are non-inherent and contingent. Examples of intrinsic associations are 'whole-part', 'individual-class', 'entity-attribute', 'different values on same scale', and 'opposites'.

An example of an extrinsic association according to Cruse is the phrase: 'number 32 is not answering'.

Furthermore, Lakoff works with a third important transference structure, which is called the radial structure. This is based on both metaphorical and metonymical qualities. According to Lakoff, a radial structure is '*one where there is a central case and conventionalized variations on it, which cannot be predicted by general rules*' (Lakoff. 1987), p. 84. The radial structures are structures that contain ideal members. The other members can only be identified through social rules/conventions and metaphorical and metonymical motivations. This means that the radial structures are conventionalized and have to be learned; radial structures are cultural phenomena. An example of a typical radial structure is the 'mother' concept. The central, ideal content in the structure is described as follows:

> *The central case, where all the models converge, includes a mother who is and always has been female, and who gave birth to her child, is married to the father, is one generation older than the child, and is the child's legal guardian. (Lakoff, 1987, p. 83)*

Lakoff reels off a string of 'mothers': stepmothers, adoptive mothers, birth mothers, natural mothers, unwed mothers etc. who all diverge from the above-mentioned conditions, but still they are mother types. The presence of well-defined subgroups makes the concept 'mother' a radial structure. However, Lakoff points out that not all-possible variations exists as categories.

> *There is no category of mothers who are legal guardians but who don't personally supply nurturance, but hire someone else to do it. There is no category of transsexuals who gave birth but have since had a sex-change operation. (ibid, p. 83)*

Metaphors, metonymies and radial structures represent different reasoning capacities. Metaphors provide transference of meaning by means of similarity, blending of

conceptual domains, metonymy by means of association, and radial structures by means of convention.

A critique one may raise against Lakoff's cognitive semantics is his examples; they all represent everyday life situations. However, how may the functions of metaphor, metonymy and radial structures apply within scholarly communities?

Within the LIS community several metaphorical conceptions are apparent; take for instance 'knowledge is a resource', which clearly expresses a conceptual metaphor.

Conceptual metaphor:	Information is a resource
Metaphorical expressions:	Information need and information use
	Exhaustive indexing
	Query refinement
	Information-as-a-thing
	Information-as-a-process

Other examples of LIS metaphors:

Information literacy
Information age
Knowledge environment
Knowledge domain
Information pathology
Knowledge map
Knowledge structure
Information value
Value adding
Information competencies

Metaphors are paramount as well within scholarly communities, and are a powerful mechanism for reasoning and for expressing new and complicated meanings.

The function of a metaphor is thus to 'blend' different concept space, and provide for new meanings. Metaphors may, however, be more or less creative and original. They are more effective when they provide for surprising relations between the source domain and the target domain. Metaphors may be considered a facilitator of new concepts; however, when a metaphor becomes generally accepted and used as a particular concept, as is the case with the list of LIS metaphors above, they function as symbols.

Metonymy is also paramount within scholarly communities. Intrinsic metonymic concepts are widespread within KOS. The very function of subject indicators as representations of subjects is of this metonymical kind. The extrinsic metonymy is also paramount, e.g. shelving books, reading Shakespeare, text consumption, etc.

The radial structured concepts are conventionally defined on the basis of cultural habits. They are not organized on the basis of logic, e.g. membership by means of necessary and sufficient conditions. Membership is defined by how the concept is used within a culture or community, and is thus highly domain specific. Identification of radially structured concepts therefore relies on domain knowledge.

If these assumptions are correct, it should be obvious that domain knowledge is of utmost importance for information specialists that create subject categories and semantic tools for KOS. It should also be obvious that the meaning of concepts is contextual - we may identify particular semantic items automatically in documents, but how these semantic items should be understood relies on the complex interplay between the text communicated by the document and the cognitive abilities of the reader.

3.2.6 Idealized cognitive models (ICM)

The ICM is an important concept within the Lakoff tradition of cognitive semantics. The ICM is defined as a complex structured whole that functions on the basis of four kinds of structuring principles: propositional structures, image schematic structures, metaphoric mapping, and metonymic mapping (Lakoff & Johnson, 1980). An ICM is defined as a mental model that controls how meaning is attributed to objects of the surrounding world.

The ICM concept is thus determined by culture. Lakoff's primary example of an ICM is the understanding of the concept 'bachelor':

> *[B]achelor is defined with respect to an ICM in which there is a human society with (typically monogamous) marriage, and a typical marriageable age. The idealized model says nothing about the existence of priests, 'long-term unmarried couplings', homosexuality, Moslems who are permitted four wives and only have three…(Lakoff, 1987, p. 70)*

Lakoff furthermore states that the ICM structure is a gestalt that cannot be broken down into smaller meaningful entities without losing the wholeness. The idea of wholeness is significant in order to understand the complexity in the ICM-situation philosophy. Situations are not similar, but thematic variations; the theme is the ICM, and the variations are different cognitive structures derived from the ICM. Since we are talking about variations that share a similarity with the theme, we are able to recognize the situations and thereby register them as thematic variations.

Because we talk about theme variations, we often experience that the ICM does not fit precisely with reality. Nevertheless, we know immediately what is meant when the topic is a bachelor, or a woman wearing a veil. The meaning is being created in the encounter between the two contexts: my preunderstanding of the concept and the context of which the concept or concepts are a part. In the sentence, 'He has just become a bachelor in library and information science', the listener must have contextual knowledge about what a bachelor is; he must also know what a librarian is, and that it is possible (in Denmark) to educate bachelors in library and information science. If he doesn't know this, he cannot decode and understand the message. There is no logical relation between libraries and bachelors; the meaning is only created through the social use of the concepts. Lakoff says:

> *If, on the contrary, someone tells me that the pope is a bachelor, another ICM will appear telling me that according to current definitions the pope cannot be a bachelor because among other things the pope is defined by his not being socially expected to marry… Under this account bachelor is*

> *not a graded category. It is an all-or-none concept relative to the appropriate ICM. (Lakoff 1987, p. 71)*

The concept 'bachelor' is thereby not a graded category. If one ICM does not fit the situation, another replaces it. Furthermore, there is a possibility that more than one ICM is triggered at the same time. Lakoff calls these 'cluster models'. Again he uses the mother concept as an example. Where the classical theory claims that it is possible to make a clear description of the mother concept to cover all types of mothers, Lakoff claims that the concept 'mother' 'is a concept that is based on a complex model in which a number of individual cognitive models combine and form a cluster model' (Lakoff, 1987), p. 74.

The cluster model is defined by being a complex model within which a string of individual cognitive models are combined. The cluster model differs from the particular radial structured concept by consisting of a string of coordinated cognitive models, whereas the radial structure has a superior concept under which the other concepts are arranged. Each cognitive model in the cluster model can thus have a radial structure. Lakoff describes several different mother concepts that have in common some representation of 'mother'. However, the issue is not how many types of mothers there are, but how complex a relatively simple concept like mother is. The cluster model contributes with meaning to the mother concept, but Lakoff points out that there may be additional mother models. There is not, as in the particular radial structures, a central mother model where the radials form subcategories. The concept 'mother' is dynamical, and the cluster model can be expanded with more models, or models can simply disappear. However, what is important in this discussion is the awareness of the fact that a concept can be defined through many ICMs.

The meaning of a concept is thus defined through the situation in which the concept is used — that is, the appropriate ICM in the appropriate situation. The ICM provides meaning to the concept. However, the receiver/user must have knowledge of the ICM and be motivated in order to decode the meaning.

The discussion of cognitive semantics raises some basic issues about the function of language and the meaning of concepts. According to Lakoff, language and cognition

cannot be separated. Language is embodied, which means that the properties of categories and concepts are consequences of the biological capacity of human perception and its experiences of acting in a physical and social environment (Lakoff, 1987). Concepts and categories are meaningful only with reference to embodied experience, where meaning is attained by means of projecting metaphorical, metonymical and radial structures into the environment. The ICM has a synthetic function that determines the overall meaning of a concept.

Based on the insights of cognitive semantics, concepts and categories cannot be determined by essentialist epistemology. Accordingly, KOS based on strong models of representation produce systems that are insensitive to the dynamics of communicative processes and knowledge production in discourse communities. The departure of cognitive semantics is that concepts and categories first and foremost are based in experience. Secondly, perception of reality is not neutral, but influenced by how language is used in communication. Thirdly, the human cognitive ability is connected to how the human body interacts with the environment; thus, kinaesthetic image-schemes play a fundamental role as pre-conceptual archetypes that influence the spatial perception of time and space and thus gives rise to basic level categorization and notions as core-concepts vs. periphery concepts. Fourthly, concepts and categories are, as a result of human cognitive capacity, essentially based on metaphor, metonymy and ICM. Essentialist epistemology should therefore be abandoned in favor of a socio-cognitive and experientialist epistemology.

I have dedicated some thought to the cognitive semantic approach, because it fundamentally proposes an alternative understanding of concepts that is in opposition to the essentialist definition of concepts. However:

> *According to essentialism and most versions of cluster analysis, classifications are constructed according to qualitative similarities that can be used for explaining or predicting the behavior of a kind's members. […]Historically based classifications, on the other hand, help us explain an entity's properties that are due to a sequence of events by highlighting the causal path underlying those events.(Ereshefsky, 2001, p. 29)*

The historical approach bases its classification of objects on continuity, a sequence of events that explains the properties of an object. This approach gives priority to unraveling the fundamental assumptions that motivate the meaning of a concept. Concepts may be graded and prototypical; however, where the cognitive semantic approach explains conceptual meaning with reference to metaphor, metonymy and ICM, the historical approach classifies objects according to their causal relations rather than their intrinsic qualitative features.

The historical approach is in particular explored in biological taxonomy, but is considered a principle not exclusively related to biology. "In fact, any discipline that identifies the parts of an entity over time or identifies the path of a causal process employs the historical approach to classification" (Ereshefsky, 2001, p. 30).

According to Hjørland, what Ereshefsky terms as the historical approach is too narrowly focused on the object of investigation, and should include the researchers' way of understanding the object of investigation as well.

> *Historicism is the ideal of basing research on social contexts, on historical developments, and on the explication of researchers' pre-understanding. It is based on the understanding that observations are "theory-laden," or culturally influenced (as opposed to neutral and "objective") processes (Hjørland, 2009, p. 1525)*

Accordingly, Hjørland argues that historicism is deeply related to hermeneutics and genealogical classification. *"To clarify a concept involves the uncovering of the discourses in which it has been developed and used as well as its underlying set of assumptions."(ibid., p. 1526)*

In the next section I will discuss how pragmatic pluralism may apply as a principle in the historical approach.

3.2.7 The evolution of scientific concepts – pragmatic pluralism

Pragmatic pluralism considers Peirce's distinction between metaphysical possibility, the realm of the consistently thinkable and independently real, within which the facts of

experience must be located, and epistemological actuality, the realm of concepts that is based on perceptual knowledge, and which can be characterized as a system of ideas that grasps or fixates the independently real through interaction.

> *…the real world is ontologically one with independent reality as an infinitely rich continuum of qualitative events. It is, metaphysically, that independently real. Yet a world is dependent upon the meaning system that grasps in a way in which reality as independent is not, for a world is that perspective of the infinitely rich reality that has been "fixed" or "carved out" by a system of ideas. Knowledge is abstractive and selective. A world, though concrete, is nonetheless selective in the sense that a world, as the concrete content denoted by a system of meanings, is a way in which the concreteness of reality can be delineated, or "fixed". A system once chosen, limits the alternatives possible within it, but alternative systems may be possible.* (Rosentahl, 1994, p. 7-8)

What is important in the above quotation is that we may distinguish between an independent reality, that contains infinite ongoing processes, and events that may be understood or explained only by a system of meanings. Rosentahl distinguishes for that reason between "reality", which is metaphysically real, and "a world" that is considered a logical fixation of an infinite number of possibilities. This distinction is in line with Bhaskar's conception of 'intransitive natural reality' and the 'transitive world' that is determined by social and historical perspective.

Reality may thus be percieved and explained through a system of ideas and gives rise to Peirce's phenomenological categories. Peirce's phenomenological categories are distinguished in a trichotomy: Firstness, secondness and thirdness.

Firstness is considered a potential of being. Secondness is an actualization of firstness, and thirdness mediates between the potential of being and the actualization. Thirdness then forms generality and habit.

Reformulating the statement above, firstness, secondness and thirdness stands in a complimentary relation: Firstness is what is potentially possible, and, thus, consistent

thinkable (the world being perceptible and conceivable), secondness is actualization of what is potentially possible, and thirdness being actually or logically possible. This trichotomy thus both constitutes what is metaphysically independently real, and what is knowledgeable. Thus, the trichotomy both expresses the metaphysical categories of reality and simultaneously forms Peirce's phenomenological categories that express what is knowable. Peirce metaphysics and phenomenology thus supply each other in a self-corrective manner.

As a consequence, concepts are, in the Peircean sense, fallible understandings of independent reality, and by fallible is meant that future investigations may continuously correct the meaning of concepts. In the Peircean pragmatic sense, concepts constitute the intelligible world; however, in order for concepts to be intelligible, reality must be intelligible as well.

Accordingly, and with Bhaskar's distinction in mind, Kuhn's theory of paradigms could arguably be considered in line with Peirce's pragmatic pluralism. Knowledge as cumulative or knowledge as changing does not lie in opposition for Peirce, "…rather knowledge as changing is also knowledge as cumulative, for any novel world emerges from a cumulative process or history, which yields enrichment of intelligibility both of the old and of the new". (Rosentahl, 1994, p. 19)

A paradigm is thus not randomly chosen, but motivated by reality and previous systems of knowledge. A paradigm in this sense constitutes a system of ideas that justifiably explains scientific knowledge, which cannot exist in isolation, but must somehow be connected, or be the result of previous and obsolete knowledge systems.

In the next chapter I will elaborate on Peirce's phenomenological categories in relation to his semeiotic theory. For now, it is sufficient to recognize that concepts as conceived by Peirce, are complex units of knowledge that implicate a distinction between reality, which is the independent real, and the world, which is considered a possible conception of reality. That there may exist numerous explications of reality, and thus epistemological plurality, and that science provides for justifiable knowledge based on experimentalism. Furthermore, knowledge is considered cumulative, and developed in a continuum. Even though theories are incompatible (or incommensurable, as stated by Kuhn), new theories should be seen as a consequence of previous theories (or reactions

against theories); thus socio-cognitive concept theories emerge in opposition to objectivist concept theories.

3.3 Discussing concept theory and KO

In chapter 2 it was argued that KOS are semantic systems that at different levels of semantic granularity organize words, classes and concepts. In this chapter I have argued that different approaches to concept theory have important consequences for how concepts are determined, delimited and structured. The important discussion now is what these consequences mean in KO.

Generally, systems falling under the different approaches to concept theory may be characterized as follows:

Essentialism – systems based on formal syntax and logical decomposition, e.g. facetted classification systems, objectivist terminology, ontologies

- Epistemology: objectivism, rationalism and empiricism
- Principle of semantic representation: univocity, standardization, vocabulary control, from general to specific
- Universalistic

Cluster analysis – statistical methods, e.g. bibliometri, associative relations, socio-cognitive terminology, prototypicity, semantic networks

- Culture relative epistemologies
- Principle of semantic representation: semantic pluralism based on empirical studies, prototypes, semantic clusters
- Synchronic, graded categories, based on perception

The historical approach – discourse analysis, domain analysis, critical theory, pragmatic pluralism

- Unraveling the meaning of concepts by studying how they attach to developments in scientific studies, how they relate to theories and paradigms, how they are used in communication, written as well as oral
- Domain analysis, discourse analysis, critical studies
- Principle of semantic representation: genealogy, semantic pluralism based on scientific evidence and perspective
- Diachronic, graded categories, based on scientific evidence

If concepts are considered from an essentialist approach, then priority is given to system designs that favor exclusive categories and logical decomposition. In particular, this includes systems that organize concepts from general to specific. This principle is dominant in the traditional types of KOS, and is in particular demonstrated by universal classification systems.

Cluster analysis is less restrictive than the essentialist approach, and concepts are considered as complex units of knowledge that may be fuzzy and organized around a prototype. The idea of center – periphery organization is important; some objects falling under a concept may be less prototypical than others, and thus more periphery related to the prototypical example that defines the concept. In cluster analysis, the distinction between concepts and categories becomes unclear, simply because there is no single exclusive way of defining the necessary and sufficient properties of category members.

Semantic networks, association test, and bibliometry[24] are examples of how the principle of cluster analysis is applied in KOS. A cluster analysis thus provides for a snapshot of a semantic structure, based on some kind of similarity measurement.

The historical approach in KO has in particular been advocated by Hjørland (Hjørland, 2002b, 2009; Hjørland & Albrechtsen, 1995), as an important aspect of domain analysis. In relation to concepts, Hjørland argues that:

> *Concepts are dynamically constructed and collectively negotiated meanings that classify the world according to interests and theories. Concepts and their development cannot be understood in isolation from the interests and theories that motivated their construction, and, in*

> *general, we should expect competing conceptions and concepts to be at play in all domains at all times.(Hjørland, 2009, p. 1523)*

As a consequence, concepts should be understood by genealogically tracing their origins, investigating their historical development, and justifying their meaning and relations to other concepts by reference to scientific theories and discourse communities.

3.4 Summary

The focus of this chapter has been to investigate into different approaches to concept theory, and to discuss how different approaches to concept theory provide for fundamentally different understandings of concepts and, successively, different models of representation.

This discussion is important because KOS's are, as argued in the previous chapter, considered semantic systems that organize concepts, based on different principles of representation, and at different levels of granularity.

The distinction between essentialism, cluster analysis and the historical approach to concept theory has been valuable in order to determine the strength and weakness of different models of representation. Essentialism thus defines concepts by necessary and sufficient conditions, i.e. a concept has an intensional definition that objectively carves reality at its joints. The strength of essentialist models of concepts is their focus on true representation of facts, a belief in true essence of things, and invariable fixed properties that defines an entity. The weakness is that essentialism disregards the role played by language and culture in concept formation.

Cluster analysis defines concepts according to prototypes, and thus abandons the essentialist approach to concept definitions. Language, communication and the social environment cannot be excluded from how concepts and categories are defined. In principle, this breaks with the universalistic approach to KO. Concepts are thus defined according to their purpose and use in actual communication. The problem that arises in cluster analysis is how to delimit concepts. Concepts may be fuzzy and prototypical, but

questions arise about what properties should be determined important, and which should not. As an example of cluster analysis in linguistics, cognitive semantics is discussed. Cognitive semantics dismisses the classical essentialist approach to concepts and categorization, and formulates a thorough critique based on empirical evidence, according to which concepts and categorization, instead of being determined by necessary and sufficient properties, rather is motivated by experience, human cognitive abilities, motor action, cultural context, and linguistic phenomena as metaphor and metonymy. As is the case with essentialism, cluster analysis also defines concepts and categories according to some intrinsic properties; some are considered more important than others, and thus graded (prototypical) categories are established. Members of a category may thus share a cluster of similar traits, however, those traits may not be present in all the members of a category. However, cluster analysis provides a synchronic picture of concepts.

The historical approach may be approached differently depending on theoretical and epistemological commitments. The historical approach, however, favors explanation based methodologies over qualitative similarity.

Pragmatic pluralism, a term suggested by Rosentahl (Rosentahl, 1994), is related to the historical approach. Pragmatic pluralism is developed based in Peirce's distinction between metaphysical possibility and epistemological actuality, which corresponds to the semeiotic distinction between dynamical and immediate object (which will be explained in detail in chapter 5). Pragmatic pluralism thus argues that concepts are complex unites of knowledge determined by external reality; however, concepts are continuously modified by investigations. Furthermore, there may exist numerous explanations of reality, due to different approaches and knowledge interests, and, science provides for the justifiable knowledge. According to Peirce, knowledge is considered cumulative and developed in a continuum, and thus historically based.

4 Semiotics

Introduction

The function of this chapter is to provide for a general introduction to semiotics and a detailed presentation of Peirce's semeiotic theory. The objective is to investigate into the constituents of a sign, how signs may be classified and understood as signs of meaning. Furthermore, the function of the chapter is to investigate into how the different types of KOS's correspond to the sign classes demonstrated. Finally, the concept of pragmatic pluralism is revisited and discussed in relation to paradigm and concepts. The chapter thus connects the discussions of concept theory to semeiotic theory and sets up the premises for the concept 'sign displacement' that will be the focus of chapter 5.

4.1 Semiotics

Semiotics is basically concerned with signs, their constituents and how they may be meaningful to somebody. However, semiotics is not a unified field or a methodology. There are several schools and branches of theoretical as well as applied semiotics. And the history of signs and the meaning of signs may be traced back to ancient times (cf. Nöth, 1990). The most common distinction of traditions made in semiotics is between the structuralist[25] tradition stemming from the Swiss linguist Ferdinand de Saussure (1857-1913) and the American philosopher Charles Sanders Peirce (1839-1914). Both traditions are concerned with the formal conditions of signs, but differ significantly in their respective theoretical foundation. A common way to express their differences is by reference to their origin; - where Peirce's semeiotic theory is developed from the perspective of logic and scientific enquiry, Saussure's semiology is based in linguistics. The difference is even more clearly stated by Liszka:

> *Peirce sees semeiotic as supplying leading principles to sciences such as general and social psychology and linguistics; it also serves to establish criteria by which such investigations can derive good results from the employment of signs and shows, in general, the formal character of signs as such. So one might say that for Peirce the relation between linguistics and semeiotic is one of discipline to methodology, or empirical science to formal science, whereas for Saussure the relation is one of general to particular discipline. (Liszka, 1996, p. 16)*

Saussure had an interest in the general structure of 'langue', and regarded 'parole' as different arbitrary manifestations of 'langue'. Saussure separates language from external reality. Meaning depends on the structure of language and the intra-relationships of signifier/signified. We know the meaning of words by its distinction and difference to other words, not by its correspondence to objective reality.

Other key figures related to the structuralist school of semiotics are the Danish linguist Louis Hjelmslev (1899-1966) who established the 'Copenhagen school', and is associated with 'glossematics' and '*Prolegomena: A Theory of Language'*, the French structuralist Roland Bathes (1915-1980), and the Lithuanian linguist Algirdas Greimas (1917-1998), who developed a version of semiotics named generative semiotics.

Peirce discussed the nature of signs vigorously on several accounts throughout his extensive and lifelong work; The French mathematician Robert Marty discovered 75 sign definitions in the writings of Peirce. These definitions are not fundamentally different in nature, but illustrate the continuous development and complexity of Peirce's semiotic. (Marty, Thellefsen, & Sørensen, 2005).

Peirce semeiotic is not dedicated to linguistic signs, but is developed from the perspective of logic and is connected to the scientific method. To Peirce, linguistic signs are important, and are considered the means of oral and written communication; however, Peirce's mature semeiotic theory is also sensitive to sign processes that take place both inside humans and outside human cognition, e.g. in nature.

Key figures following the Peircean pragmatic school are the American semiotician Charles W. Morris (1901-1979), the Italian poly math Umberto Eco (b. 1932), and the American founder of zoosemiotics Thomas Sebeok (1920-2001)[26].

4.2 Peirce's semeiotic[27]

As stated previously, semiotics is a field that consists of different schools and branches of theories of applied nature. Peirce's conception of semeiotic and consequently his definition of a sign, became gradually more sophisticated as his idea of pragmaticism developed, and vice versa; however, the basic trichotonomical structure of the sign remains largely the same. Yet, it is difficult to formulate a concise, exclusive definition of Peirce's semeiotic; because the semeiotic theory is closely related to other areas of Peirce's philosophy.

Fundamentally a sign consists of three interrelated irreducible parts: a sign, an object and an interpretant (CP 2.228).

Peirce's work on semeiotic progressed through different periods of his life, and his definition of sign (representamen, sign vehicle, or ground), object and interpretant evolved and became gradually more sophisticated and complex. Consequently, Peirce's theory of semeiotic, can be divided into three main stages: An early phase that establishes the basic constituents of the sign structure[28], an interim stage, where Peirce worked on a classification of sign types and a final stage where the object is divided into the 'immediate object' and the 'dynamical object'. Also, the interpretant is here divided into several trichotomies that address different conceptual levels in the signification process. One important trichotomy is the division of the interpretant into the 'immediate interpretant', the 'dynamical interpretant' and the 'final interpretant' (CP 4.536; 8.314-315). The different conceptual levels of the interpretant will be addressed in detail in chapter 5.

Peirce's early account of semeiotic suggests the concept of infinite semiosis. A sign process is thus always a consequence of a previous sign process, and the interpretant will always establish itself as a sign in a successive sign chain. Also, Peirce's early account of a sign is considered nominalistic and associated with cognition.

> *An interesting feature of Peirce's early account is that he is keen to associate signs with cognition. […] We can see this from Peirce's early idea that every interpretant is itself a further sign of the signified object. Since interpretants are the interpreting thoughts we have of signifying relations, and these interpreting thoughts are themselves signs, it seems to be a straight-forward consequence that all thoughts are signs, or as Peirce calls them "thought-signs" (Atkin, 2006)*

According to Peirce:

> *A sign stands for something to the idea which it produces, or modifies. Or, it is a vehicle conveying into the mind something from without. That for which it stands is called its object; that which it conveys, its meaning; and the idea to which it gives rise, its interpretant. The object of representation can be nothing but a representation of which the first representation is the interpretant. But an endless series of representations, each representing the one behind it, may be conceived to have an absolute object at its limit. The meaning of a representation can be nothing but a representation. In fact, it is nothing but the representation itself conceived as stripped of irrelevant clothing. But this clothing never can be completely stripped off; it is only changed for something more diaphanous. So there is an infinite regression here. Finally, the interpretant is nothing but another representation to which the torch of truth is handed along; and as representation, it has its interpretant again. Lo, another infinite series. (CP 1.339)*

Peirce's first classification of signs consists of three sign types: 'Icon' (or likeness), Index' and 'symbol'. An icon relates to its object by mere quality, an index relates to its object by correspondence to fact, and the relation of a symbol is an 'imputed character' (CP 1.558). Later (the interim stage), Peirce developed the three types into ten classes (see fig. 4:2) of signs, based on three sign trichotomies[29].

	1	2	3
1	Qualisign	Icon	Rhem

2	Sinsign	Index	Proposition/dicent sign
3	Legisign	Symbol	Argument

Table 5: The three trichotomies (CP 2.243-52)

The first trichotomy is concerned with the formal features of the sign, i.e. "…the general conditions of signs being signs" (CP 1.444).

The second trichotomy is concerned with the necessary conditions by which signs can say something truthful about the objects they represent (CP 2.229).

The third trichotomy should be understood as "the necessary conditions of the transmissions of meaning by signs from mind to mind" (CP 1.444).

Peirce named these trichotomies of semeiotic *'formal grammar'* (CP 1.559, 4.116, 8.342), *'critic'* (CP 1.191, 2. 92), and *'formal rhetoric'* (CP 1.559, 8.342).[30]

> *So, whereas semeiotic grammar is the study of what must be true for signs qua signs and critical logic is the study of the conditions for the proper use of signs, or truth, formal rhetoric is the study for the formal conditions under which signs can be communicated, developed, understood, and accepted. (Liszka, 1996, p. 11)*

4.2.1 Phaneroscopy

Peirce named his phenomenology '*phaneroscopy'* which is the study of the phaneron (the phenemonon), by which Peirce meant: "the collective total of what is in any or any sense present to the mind, quite regardless of whether it corresponds to any real thing or not." (CP 1.284)

> *What I term phaneroscopy is that study which, supported by the direct observation of phanerons and generalizing its observations, signalizes several very broad classes of phanerons; describes the features of each; shows that although they are so inextricably mixed together that no one can be isolated, yet it is manifest that their characters are quite disparate; then proves, beyond question, that a certain very short list comprises all of these broadest categories of phanerons there are; and finally proceeds to*

> *the laborious and difficult task of enumerating the principal subdivisions of those categories. (CP 1.286)*

The elements being studied in Peirce's phaneroscopy are indecomposable elements exemplified by the most basic categories that according to Peirce are three and only three (CP 1.292; 1.418): A first, 'quality'; a second, 'actuality'; and a third, 'law'. Examples of monadic qualities are red, bitter, tedious, hard, heartrending and noble, which are all qualities of things and events.

The phaneroscopic categories are thus named: 'firstness', 'secondness', and 'thirdness'. To Peirce, firstness is latent and vague and is contained in the external world. Firstness exists by virtue of itself, *sui generis*, independent of anything. Firstness is called monadic on the basis of this monovalent relation. A pure monad is a quality which in itself is without parts, without any features, and, furthermore, it is not embodied.

Secondness is defined as a dyadic relation between the sign and its object. Peirce's dyad is defined as follows: "*The dyad is an individual fact, as it existentially is; and it has no generality in it. The being of a monadic quality is a mere potentiality, without existence. Existence is purely 'dyadic'"* (CP 1.328). The relation is dyadic, that is, something 'else' exists as a binary entity to something 'first'. To a force — a counter force, to will — corresponding unwillingness, etc. (CP 1.24).

The relation between firstness and secondness is dyadic in the sense that the quality in itself does not constitute the fact, but is tied to the fact. Thirdness is defined as the category of generality, comprehensibility, rationality, and regularity (CP 2.436; 2.332; 5.536). The concept 'force of habit' (CP 1.299-300) is central to Peirce, thus, he considers natural laws as manifestations of habit formation in nature.

Thirdness is the mediator between firstness and secondness. Thirdness completes the triad, and the triad signifies the triadic relation. The triadic sign is thus more than merely a binary relation, and the triad is non-reducible. Peirce describes the relationship between thirdness on one hand and firstness and secondness on the other hand in the following way:

> *By the third, I mean the medium or connecting bond between the absolute first and last. The beginning is first, the end second, the middle third. The end is second, the means third. The thread of life is a third; the fate that snips it, is second. A fork in a road is a third, it supposes three ways; a straight road, considered merely as a connection between two places is second, but so far as it implies passing through intermediate places it is third. (CP 1.337)*

Thirdness is thus identical with the Interpretant of the sign (Dinesen, 1994). For a sign to mean something there must be some kind of regularity behind. This regularity could be a social habit — a reaction to the sign — or the sign could designate some regularity in nature. Let me summarize the nature of and relations between firstness, secondness, and thirdness with a quotation from Peirce:

> *First is the conception of being or existing independent of anything else. Second is the conception of being relative to, the conception of reaction with, something else. Third is the conception of mediation, whereby a first and a second are brought into relation… The origin of things, considered not as leading to anything, but in itself, contains the idea of First, the end of things that of Second, the process of mediating between them that of Third…In psychology Feelings in First, Sense of reaction Second, General conception Third. ...In biology, the idea of arbitrary sporting is First, heredity is Second, the process whereby the accidental characters become fixed is Third. Chance is First, Law is Second, and the tendency to take habits is Third. Mind is First, Matter is Second, Evolution is Third. (CP 1.32)*

In the previous section, Peirce's early account of the sign has been addressed, followed by the three important basic phaneroscopic categories, namely: firstness, secondness and thirdness. In the following section Peirce's sign trichotomies and sign classes are addressed in further detail.

4.2.2 Sign trichonomies

According to Peirce, a sign implicates the interplay of three constituents; the three trichonomies that addresses each of the basic phaneroscopic categories in relation to firstness, secondness, and thirdness (see fig. 3:1). Peirce explains:

> *First, according as the sign in itself is a mere quality, is an actual existent, or is a general law; secondly, according as the relation of the sign to its object consists in the sign's having some character in itself, or in some existential relation to that object, or in its relation to an interpretant; thirdly, according as its Interpretant represents it as a sign of possibility or as a sign of fact or a sign of reason. (CP 2.243)*

The first division of the sign trichonomies is within the category of firstness, which in the sign triad is the representamen. It consists of qualisign, sinsign and legisign. The qualisign is defined as being a quality of a sign. Before the manifestation of the sign, another sign must carry it. Since a quality is — what it is — positive and within itself, a quality can only describe an object due to some kind of resemblance or a shared element, i.e. a qualisign necessarily has to be an icon, and when a quality is a logic possibility, the qualisign can only be interpreted as a sign of being, i.e. as a rheme. An example of a qualisign is the experience of red. The color red will, of course, be carried by some thing or some event (secondness).

The following model establishes an overview of the sign types distributed into the respective axis of the sign. The model also serves the purpose of connecting the sign trichiotomies into sign classes.

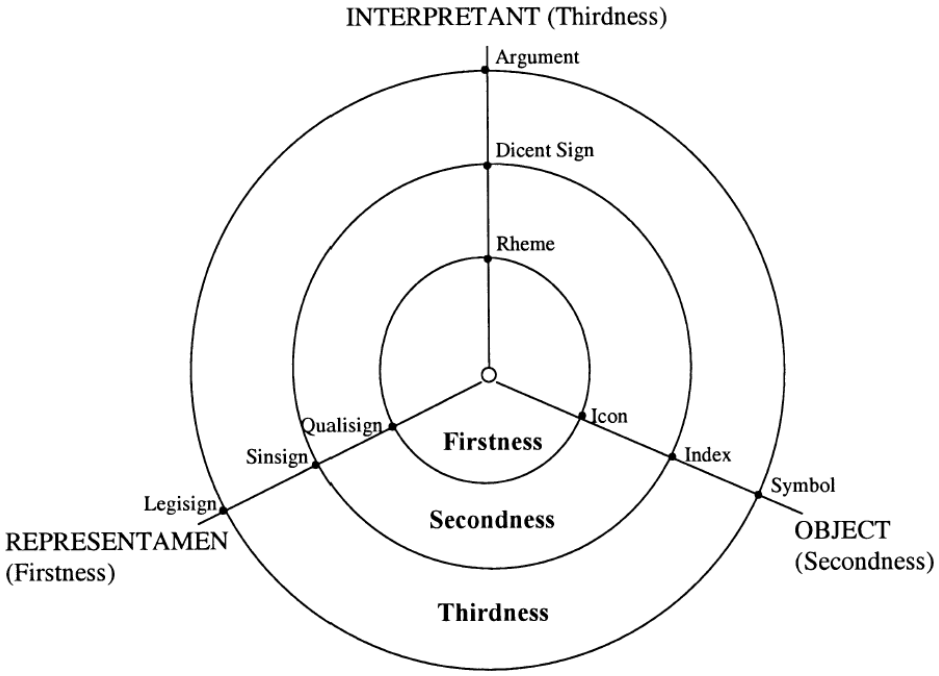


Figure 4:1. Firstness, secondness and thirdness: The figure shows how the sign types relate to firstness, secondness, and thirdness. Each leg in the triangle corresponds to the parts in the sign relation: Representamen, object and interpretant. The graph is thus made with firstness closest to the center, secondness in the middle, and thirdness farthest away from the center. The figure quoted from (Brier, 2008, p. 277)

The first class of the sign, starting from the inner circle of the axis of the representamen, is 1)[31] a qualisign (CP 2.254). After the qualisign comes the sinsign. The sinsign is an actual thing or event as a sign. The sinsign exists only through its qualities; therefore it contains or carriers several qualisigns.

Sinsigns have the following combinations: 2) an iconic sinsign, 3) a rhematic indexical sinsign, and 4) a dicent indexical sinsign (CP 2.255-257).

The third class in the first trichonomy is the legisign. Peirce defines the legisign as a law which is a sign. The lawfulness is defined and determined by the users. That is why the legisign is a conventionalized sign. Each conventionalized sign is a legisign, but not necessarily the other way around. Peirce states that the Legisign is not a single particular object which one has to agree on as being a carrier of meaning, but is a general type. We are still within the category of firstness, or the representamen part of the triadic sign.

Take the letter A as an example of the differences between qualisign, sinsign and legisign. The letter A can be interpreted as 1) black strokes (qualisign), 2) a successful example of a type in a composing room (sinsign), or representing the class we call 'the letter A' (legisign). So the fifth to tenth sign categories are Legisigns: 5) iconic legisign, 6) rhematic indexical legisign, 7) dicent indexical legisign, 8) rhematic symbol legisign, 9) dicent symbol, and, finally, 10) an argument (CP 2.258-263).

The best-known and most used trichonomy is the representamen-object relations: Icon, index, and symbol.

The icon is a sign that shares a resemblance to the object it represents. Common examples of iconic signs are photographs, since they resemble the object (i.e. the model) they depict. Thus, a photograph is an icon, and sometimes an index, when the photograph has a causal relation to the object it depicts.

Index means reference (to something). This class is constituted of signs which have a causal relation to the objects they describe. The sign refers to the object, which it describes by virtue of a relationship where the sign is caused by the object, like smoke is an index for fire. An index is thus a sign that stands for its object by virtue of a direct reference to the object, i.e. footsteps points to the person who walked past.

A symbol is a sign that refers to its object, which it denotes by virtue of a law. Peirce clarifies this by stating that the law is an association of common ideas, it means that the symbol will be interpreted as pointing to the object. Thus, a symbol is a sign that has meaning solely by virtue of rules and conventions. A sign being conventionalized means that among users there is an agreement on the meaning of the sign. Letters, words, numbers are such examples of symbolic signs.

According to Peirce, the symbol is a genuine sign. The relation between the sign and the object is sustained solely through the interpretant. "*A Genuine Sign is a Transuasional Sign, or Symbol, which is a sign which owes its significant virtue to a character which can only be realized by the aid of its Interpretant*." (CP 2.92)

Without the interpretant there is no relation between the sign and the object. It is this non-reducible triadic unity which makes the sign genuine.

The third sign trichonomy – the intepretant - consists of rheme, dicent sign, and argument, and constitute the meaning or synthesis of a sign relation.

Rhemes refers to possible objects. As examples of rhemes one can mention nouns, as they clearly refer to possible objects. As Umberto Eco claims, signs are the prerequisite for lying, since the object does not have to be present at the same moment as the representamen. So the objects referred to are only possible.

Dicent signs are signs of actual existence. For that reason, the dicent sign cannot be an icon. The icon does not provide an opportunity of interpretation. In order to describe the case, to which they are interpreted as a reference, dicent signs must necessarily contain a rheme. Examples of dicent signs are whole sentences, i.e. propositions.

The argument is a lawsign. An argument represents its object in its capacity of a sign. This means that something is being stated about the sign. An example of an argument is whole passages of text, i.e. meaningful links of dicent signs, or simply an inference based on propositions.

The category of thirdness has the function of mediation between a first and a second. Thirdness is thus distinct from the other categories, in that it relates to the meaning of the sign.

4.2.3 The ten sign classes

Peirce develops a classification of 10 basic sign classes. The 10 classes of signs are a consequence of classes logically excluding each other. A qualisign will always be a rhematic iconic sign, and a symbol will always be a legisign, and an argument will always be a symbolic legisign, etc. Peirce's ten basic classes of sign types are organized figure 4:2 and illustrates that two classes, which border on each other with a thin line, share similarities in two ways, for example indexical sinsign (3, 4) or (1, 5), that are both iconic and rhematic. But where the thick black line divides the classes between 2 and 6, 6 and 9, 3 and 7, this is not the case, and neither can classes share similarities if they do not border on each other. The classes have been given the shortest possible names that distinguish them from each other. The names of the classes are in bold.

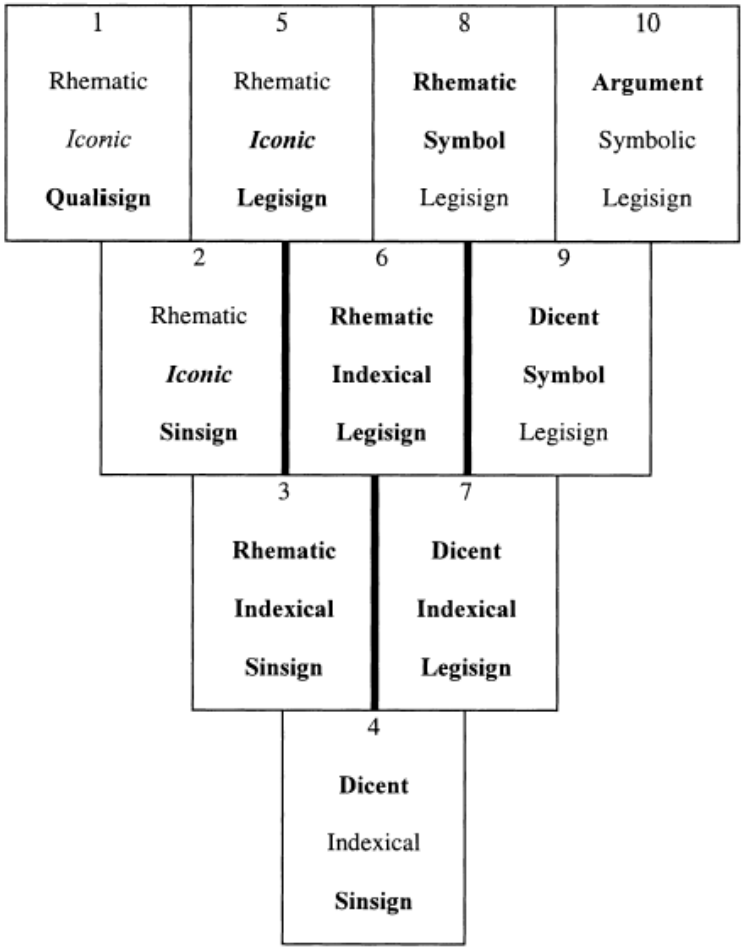


Figure 4:2. Peirce's ten basic classes of sign types (CP 2:254)

In this way, Peirce manages to conceptualize ten basic different categories of signs. The sign classes are defined as thoroughly as they are, because it is my intention to underline the interplay between the classes, and to stress the fact that index terms contain elements from all the sign classes that are defined through firstness, secondness, and thirdness.

In relation to KO, a subject indicator, as e.g. an index term functions as an interpretant and thus resides in the category of thirdness; however, thirdness is defined as the most developed sign category - the category for reasoning, representation and mediation. A subject indicator will therefore always be a conventionalized term; and, whether it is a controlled subject indicator (a descriptor) or not, a subject indicator must be a symbol.

A controlled subject indicator, however, is a symbol that is either a lexeme within a system of interrelated lexemes, or a numerical code that likewise is part of a systematic organization of codes. The meaning expressed by a subject indicator is therefore also determined by its relation to other subject indicators.

A subject indicator thus labels a concept; meaning that an object that falls under a concept is labelled by a particular subject indicator. Therefore, a subject indicator also has to be a Legisign, because there needs to be some kind of regularity behind an expression. Furthermore, a subject indicator would in isolation be a rhem which corresponds to a word (or in the case of KOS, term lists). Subject indicators are, therefore, in the terms of semeiotic, rhematic symbols (see fig. 4:2 (8)).

Following this line of thought a bit further, the more developed sign, a dicent symbol, would include a general idea, thus rendering the sign with a proposition of some kind. The rhematic sign may correspond to the arbitrary sound pattern, the signifier of Saussure; however, a dicent symbol includes a signified in relation to an object. In other words, a dicent symbol may be defined as meaningful propositions about the world.

> *A Dicent Symbol, or ordinary Proposition, is a sign connected with its object by an association of general ideas, and acting like a Rhematic Symbol, except that its intended interpretant represents the Dicent Symbol as being, in respect to what it signifies, really affected by its Object, so that the existence or law which it calls to mind must be actually connected with the indicated Object (CP 2.262).*

As we may infer from this quotation, there resides an idea of correspondence in the quotation above that the proposition should be connected with the object indicated by the proposition. We may thus speak of true and false propositions about objects.

The argument works through the principles of logic. An argument, thus, includes the dicent symbol, and has the function of inference by means of the logical principles of induction, deduction and abduction.

The purpose of this excursion through the basic sign categories is to demonstrate that representation is complex and that the indexing process implies these elements of logic. Within communication and linguistics the types of signs we address are almost

exclusively related to the category of thirdness, the interpretant, but it is important to realize that the category of thirdness emerges on the basis of a first and a second. The signs that emerge on the basis of the phaneroscopic categories of firstness and secondness are presupposed in the category of thirdness. Therefore, an argument, which may be regarded as the most developed sign category, includes the Legisign of firstness, the symbol of secondness and the ability to connect the sign with its object by means of reason, which is the function of thirdness.

In the above section Peirce's concept of sign has been presented, and the various sign classes have been addressed; now I will demonstrate how indexing or knowledge representation may be related to different types of signs. It is argued that the process of indexing necessitates a differentiation of sign classes.

4.2.4 KOS and sign classes revisited

Revisiting the taxonomy of Hodge (2000), the different types of KOS may be related to their forms of logic. Knowledge organization systems are systems that express different levels of semantic relations. The function of the first level semantic system (term lists) is to establish a controlled vocabulary of index terms used to state the subject of a document. Furthermore,

> *The purpose of controlling vocabulary is to avoid authors defining meaningless terms, terms which are too broad, or terms which are too narrow, and to prevent different authors from misspelling and choosing slightly different forms of the same term. (Garshol, 2004, p. 381)*

Term lists consequently provides authority control of subject terms, and, thus, consistency in indexing. Additionally,

> *It is common to distinguish between* term *and* concept *by saying that the former is the name of a concept, and that the same concept may have multiple names, and also that the same term may name multiple subjects. A controlled vocabulary consists of terms, and not directly of concepts,*

> *and in general each term will be disambiguated to refer to a single subject (that is, there will be no duplicate terms) (Garshol, 2004, p. 381)*

Consequently, the term names a concept, but not the concept as a whole, but a particular aspect of that concept. In relation to the sign category of thirdness, term lists establishes a connection between a sign (a symbolic rheme) and its object. The 'Term' is the sign vehicle; it is a rheme that stands for an object by means of a particular standardized subject relation. However, the term is also symbolic because it is based in a conventionalized meaning, and a legisign, because any symbol adheres to a general law. Considering the sign categories within the context of KOS, a rhematic symbolic legisign is a common noun, which names an item. Accordingly, term lists are semantic tools that provide lists of common nouns. Term lists consequently relates to the sign category of rhematic symbolic legisigns (or just rhematic symbols).
Peirce writes:

> *A Rhematic Symbol or Symbolic Rheme [e.g., a common noun] is a sign connected with its Object by an association of general ideas in such a way that its Replica calls up an image in the mind which image, owing to certain habits or dispositions of that mind, tends to produce a general concept, and the Replica is interpreted as a Sign of an Object that is an instance of that concept. (CP 2.261)*

Classification and categorization schemes represent a more developed level of KOS. A class is thus defined by properties, which determine the class members. Consequently, a class implies reasoning between two target areas. For instance, between a particular and a general, x is a kind of y, i.e. by defining the particular x as a kind of a general type.

> *A Dicent Symbol, or ordinary Proposition, is a sign connected with its object by an association of general ideas, and acting like a Rhematic Symbol, except that its intended interpretant represents the Dicent Symbol as being, in respect to what it signifies, really affected by its Object, so that the existence or law which it calls to mind must be actually connected with the indicated Object. (CP 2.262)*

The dicent symbol picks aspects of the object according to a particular intended interpretant (see table 6). However, an object may be picked according to different laws for instance, the subject of a document may be judged differently by different classification systems, by different indexers and by different scientific communities.
Relationship lists are semantic tools that provide for a hierarchical organization of concepts and, furthermore, express different types of subject relations between concepts.

> *An Argument is a sign whose interpretant represents its object as being an ulterior sign through a law, namely, the law that the passage from all such premisses to such conclusions tends to the truth. Manifestly, then, its object must be general; that is, the Argument must be a Symbol. As a Symbol it must, further, be a Legisign. (CP 2.263)*

	Phenomenological category	Relation to object	Relation to the interpretant	Semantic category
1. level KOS	Legisign	Symbolic	**Rhematic**	common noun (words, terms)
2. level KOS	Legisign	Symbolic	**Dicent**	Proposition, description, assertions
3. level KOS	Legisign	Symbolic	**Argument**	Inference (A syllogism)

Table 6: Three semantic levels of KOS

The argument functions at a more general level than the rhematic symbol and the dicent symbol. The argument is speculative, and provides for different kinds of inferences between a sign and its object. The argument may consider a sign relation as probable, necessary or possible. The probable relation relates to induction, the necessary to deduction and the possible to abduction.

Accordingly, relationships between a rheme and its object may be provided by means of inductive reasoning, i.e. an instance of an object that gives rise to a general idea, i.e. a usual interpretant[32] that is based on previously experienced instances of a particular kind.

The deductive function, which is an aspect of classification and thesaurus systems, is expressed by the hierarchical structure that organises classes in sub-classes and terms in narrow and broader terms.

The abductive function provides relations between terms or concepts that are neither probable nor necessary, but possible. A possible relation between terms or concepts is less strict, but instead associative. In thesaurus systems the function of 'related term' is an associative relation that may give rise to new ideas or alternate search strategies.

4.2.5 Paradigms and concepts

The meaning of a sign is related to its object. And, as argued by Bhaskar, an object may be conceived as either intransitive or transitive, the former addressing the realist claim that reality exists independently of a perceiving mind, and the latter, that human social activity emerges from the intransitive reality, and produces socially contingent systems of knowledge.

Therefore, we may argue that scientific knowledge about intransitive objects gradually evolves in the direction of certainty; however, that may not be the case with transitive objects.

The concept of realism is by no means as simple. Realism is as put by Niiniluoto (2002), an overstrained catchword in philosophy that is promoted with divergent and more or less exclusive definitions. For example, we may speak of ontological or metaphysical, semantical, epistemological, axiological, methodological and even ethical realism. And one may be a realist about one of these matters, but anti-realist about others. What is meant by the concept of realism, therefore, needs to be explicated further.

The simplest level of explication is the basic realist claim that a mind-independent reality exists, no matter what we may think about it. The mountains existed before man, and will probably continue to exist interdependently of human perception. However,

this kind of argument seems rather obvious, and even declared anti-realists may agree that a mind independent reality exist; it is a question of beliefs. Differences emerge however when we relate realism to conception or epistemology. We may thus believe that a mind independent reality exists, however, we may at the same time believe that this mind independent reality, no matter how real we believe it to be, remains hidden, and inarticulate. As argued by proponents of the 'linguistic turn' in philosophy of language, perception and cognition are inseparable from language. Language thus influences how concepts are formed and how reality is perceived. This insight was what Wittgenstein proposed in his 'Philosophische Untersuchungen' (Wittgenstein, 1958).

Similarly, the concept of objectivism is related to realism, and subjectivism is regarded as the logical opposite. However, the distinction between objective and subjective needs further explication.

Firstly, the distinction between objective and subjective is not mutually exclusive. Even generals are observed subjectively. E.g., the concept of an intepretant relates to a process of interpretation within the sign trichotomy that presumes a mind. Secondly, objectivism is related to realism by claiming that truth is corresponding with facts.

However, what may be stated as facts may more correctly, according to pragmatic philosophy, be thought of as provisional knowledge claims that are revisable by future investigations. The experimental fact is thus determined based on what is likely induced from observations and leaves room for future experimentation.

We may also speak of two different kinds of realities, one that is independent of what we may think about it (ontological realism), and one that depends on perception and social conduct (epistemology). But, if subjectivism takes part in the production of knowledge, how is it possible to claim an independent reality, and how do we know it is not merely another figment of subjective or even social imagination? Some standard common sense answers to this problem are 'why go around a table if it is merely a figment of imagination?', or 'How can certain general laws of nature be discovered if they are not real?', and 'if predictions can be grounded in the assumptions of general laws of nature, would it not verify the existence of general law and, thus, an objective reality?' As put by Outhwaite (1987, p. 19), " *Realism is, then, a common-sense*

ontology, in the sense that it takes seriously the existence of the things, structures and mechanisms revealed by the sciences at different levels of reality."

However, knowledge which is based on experience and common sense realism may be based on a false ontology. That is why there is an element of belief in science; we must be confident that scientific theories produce true or at least provisionary true knowledge, otherwise science is a meaningless enterprise. Still, "*This does not mean that any theory or explanation is as good as any other; only that there is no philosophical concept of Truth which can provide the ultimate seal for a particular account*" (Outhwaite, 1987, p. p. 33).

Peirceian semeiotic constitutes a theory of reasoning (critic), and the pragmatic maxime constitutes a mode of inquiry (methodeutic), (CP 2.191). "*But pragmatism does not undertake to say in what the meanings of all signs consist, but merely to lay down a method of determining the meanings of intellectual concepts, that is, of those upon which reasonings may turn.*"(CP 5.8)

It is important at this point to point out that for Peirce the pragmatic maxime is a general method for ascertaining the meaning and truth of an intellectual conception by considering its conceivable consequences, that which may follow logically from the conception. Furthermore, for Peirce, the Pragmatic maxime is connected to his concept of truth, where truth is that upon which reasoning in the long run may turn.

Consequently, according to Peirceian philosophy, we should be optimistic about science and the outcome of scientific investigations. However, we should also be prepared to revise or abandon theories and beliefs if their conceivable consequences turn out to be false. The Norwegian Peirce scholar Peter Skagestad summarizes Peirce's pragmatic realism in the following way:

> *The real is that which remains confirmed by all investigators in the long run, that which forms the object of the final opinion that will be reached through the indefinite prolongation of inquiry. Knowledge does not, therefore, consist in the subjective feeling of certainty of any individual, but in that final and unshakeable consensus which the community of investigators reaches when nobody any longer doubts a particular belief. (Skagestad, 1981, p. 29)*

Peirce is a fallibilist: Any belief or conception may turn out to be false, and any knowledge claim or belief should be critiqued if we find reason to doubt it.

There may be affinities between Peirce's fallibilism and Popper's falsificationism, cf. (Chauviré, 2005); both are dedicated to the logic of scientific discovery, Peirce promoting a critical common senseism, and Popper a critical rationalism. Both are realists at the ontological level, but differ in their view on the status of induction (Peirce claiming that verification is possible in the long run vs. Popper introducing the concept of falsificationism: truth can never be verified, only falsified due to the problem of induction).

A parallel to the realism of Peirce may be seen in the contemporary philosophy of critical realism. The British philosopher and sociologist, Roy Bhaskar, argues in favor of a critical or transcendental realism (Bhaskar, 1978), where reality is conceived in three separate domains:

1. the real (made up of entities, mechanisms etc.)
2. the actual (made up of events)
3. the empirical (made up of experience)

These domains are distinct and resemble Peirce phaneroscopic categories: firstness, secondess and thirdness. There is contingency between level 1 and 2, and 2 and 3; however a third presupposes a first and a second. In other words; actualization, i.e. manifestations of events, is contingent, but dependent on it being possible. Events cannot occur without entities or mechanisms performing these events. Human social activity cannot occur without a biogenetic life form, and knowledge emerges from experience. Knowledge is, thus, emergent properties of human social activity.

Consequently, knowledge is indirectly about reality, based in social activity, and, therefore, we may consider our knowledge to be on the path of increased certainty, or else time will show that it rests on false interpretations or knowledge claims.

Peirce describes the conditions of scientific progress in the following manner:

> *The only end of science, as such, is to learn the lesson that the universe has to teach it. In Induction it simply surrenders itself to the force of facts.*

> *But it finds ... that this is not enough. It is driven in desperation to call upon its inward sympathy with nature, its instinct for aid, just as we find Galileo at the dawn of modern science making his appeal to il lume naturale. But in so far as it does this, the solid ground of fact fails it. It feels from that moment that its position is only provisional. It must then find confirmations or else shift its footing. Even if it does find confirmations, they are only partial. It still is not standing upon the bedrock of fact. It is walking upon a bog, and can only say, this ground seems to hold for the present. Here I will stay till it begins to give way. (CP 5.589)*

Accordingly, science does not provide objective certain knowledge, but provisionary knowledge. The ground which at some point in time seemed solid may give away, and one may have to revise the entire knowledge base in order to find a new footing on the mushy ground of science.

There may be, as argued in the previous chapter, some resemblance between Peirce's fallibilism and Kuhn's paradigm theory. According to Kuhn, scientific knowledge is organized around a paradigm, which is a socially constructed hegemonic knowledge structure that serves the purpose of consolidating what counts as valid knowledge within a scientific domain.

According to Kuhn and Peirce, scientific knowledge is not absolute, but amendable to change. But where Kuhn, as agued by Skagestad, sees the change of paradigms as non-cumulative and, successively, theories within different paradigms as incommensurable, Peirce regard science as cumulative (cf. CP 1.157).

> *... few thinkers familiar with the history of science would deny that scientific terms change their meaning through changes in scientific theory. What is controversial is only weather such changes are progressive or arbitrary. This does not make Peirce's position equivalent to Kuhn's; Peirce held that scientific terms grow more precise through the progress of knowledge, hence their changes of meaning have a definite direction, that of greater precision. By maintaining, for instance that the term 'mass' in Einsteinean physics is incommensurable in meaning with the term*

> *'mass' in Newtonian physics, Kuhn appears to deny that meanings change in the direction of increased precision, and his conclusions seems to be that the meanings of scientific terms change in an essentially arbitrary manner which can be asserted only by historical research. (Skagestad, 1981, p. 127)*

This difference pointed out by Skagestad pinpoints the common understanding of the difference between Peirce's pragmatic realism and Kuhn's constructivism. Consequently, Kuhn cannot be a realist about concepts or knowledge, because changing paradigms are considered incommensurable and changes the meaning of concepts and what counts as knowledge within a community. According to Peirce, science does not advance by revolutions, but by *"...each researcher's taking advantage of his predecessor's achievements and by his joining his own work in one continuous piece to that already done."* (CP 1.157)

In chapter 3, however, it was argued that Peirce and Kuhn may be related under the term 'pragmatic pluralism'. According to this view, a paradigm may be considered what Peirce argues as provisional knowledge. The important argument is that Kuhn's theory of paradigms and their epistemic nature may correspond with Peirce's notion of fallible knowledge (CP 1.37; 2.142), consequently,

> *Reality answers our questions and determines the workability of our meaning structures, but what answers it gives are partially dependent on what questions we ask, and what meaning structures work are partially dependent upon the structures we bring*
> *...*
> *Consequently, there must be a pragmatic interplay between our concepts and actual experience (Rosentahl, 1994, p. 10)*

Fallible knowledge may be justified by experience, however, it is relative to what is already known, and to theories believed to be true. Knowledge is thus emerges from community and collateral experience. Accordingly, Kuhn's notion of a paradigm resembles Peirce's notion of universe of discourse that determines a set of premises and methodological possibilities. It sets up a system of knowledge that determines and limits

what count as knowledge. However, alternative systems of knowledge may be possible. A system of knowledge may be delimited by facts, but facts are never neutral or independent of perspective and the selective knowledge process.

4.3 Summary

In this chapter I have provided a short overview of the most important concepts related to Peirce's semeiotic. It is by no means exhaustive, but sufficient in order to establish a basic understanding of how the sign classes are connected and related to the phaneroscopic categories: Firstness, secondness and thirdness. This basic understanding of semeiotic is prerequisite for the argumentation that follows in the next chapter, which has a particular focus on the category of thirdness and the elaboration of the concept 'sign displacement'.

As described above, Peirce's semeiotic theory developed through different stages. First, a nominalist stage, that analyzed the function and constituents of the sign from the perspective of logic, thus, giving priority to symbols as in formal logic. Later, Peirce developed his sign system and established a system of 10 sign types. The addition to the previous conception of the sign is its basis in three sign trichotomies, where the category of firstness is introduced. A sign is, thus, considered a combination of the three trichotomies which creates 10 possible types. I have demonstrated that KOS's may be analyzed according to the semantic levels that relate to different types of semeiotic thirdness.

In Peirce's mature semeiotic, the object is divided into immediate and dynamical object, and the interpretant is divided into several trichotomies. In particular, the division of the interpretant into the 'immediate interpretant', the 'dynamical interpretant' and the 'final interpretant' (see fig. 4:2), is important because it expresses the general level of signification and can be elaborated by further trichtomies into a semeiotic theory of concepts and communication. Also, it expresses the provisionary relationship that exists between a sign and its object. Consequently, a sign cannot represent its object absolutely, but only immediately.

This insight is important in relation to KOS, because a KOS establishes an immediate relation between a user request and an information system. Furthermore, the distinction between dynamical and immediate object suggests that the relation between a subject representation and the subject itself (the whole concept) is incomplete, but motivated by perspective and preunderstanding.

Finally, the concept of realism was discussed and related to the concept of pragmatic pluralism and Kuhn's paradigm theory. I have thus, by means of Rosentahl's work, established a connection between Peirce pragmatism and idea of fallible knowledge, and Kuhn's theory of paradigms.

What remains is to investigate the relation between a representation of some kind and the meaning attached to it. The relationship between a representation and its meaning is thus the focus of the next chapter.

5 Thirdness and the concept of sign displacement

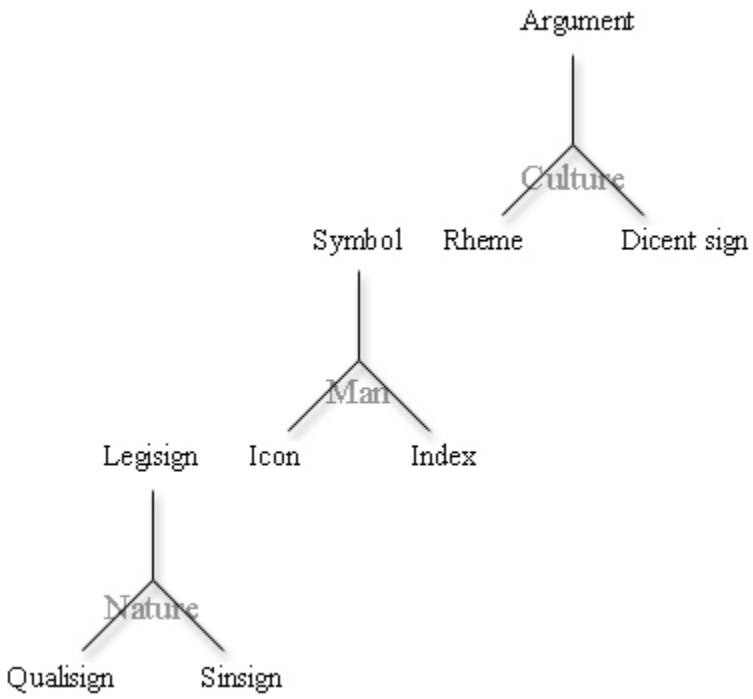
Introduction

This chapter has a particular focus on the function of the interpretant in Peirce's semeiotic. Three trichotomies of the interpretant are discussed and related to 'signification', 'cognition', and 'communication'. These separate trichotomies of interpretants provide for a full spectrum of the signification process. The concept of sign displacement is developed and related to the distinction between the immediate object and dynamical object, and KOS's are considered in relation to communication.

5.1 Sign displacement

The concept of sign displacement as a particular understanding of the relation between firstness and thirdness was introduced by Torkild Thellefsen in his Ph.D. (2002). The concept of sign displacement is here defined as a displacement between nature and culture, where nature is considered that which exists independently of intellectual concepts, i.e. an ontological ground, and culture is considered the intellectual and cultural determination of what counts as knowledge. T. Thellefsen explains:

> *A sign displacement is the semiotic gap between a Representamen and a sign. For a Representamen to become a sign, it must merge with an object through an interpretant. A sign only exists as a sign when it contains an object and an interpretant. The Representamen does not contain an object or an interpretant. A Representamen expresses possibility whereas a sign is a concrete interpretation of the Representamen. Therefore, the displacement occurs from potentiality to concreteness.(ibid., p. 48)*



Figur 5:1 Sign displacement (cited from T. Thellefsen 2002, p. 76).

In the terms of Rosentahl (Rosentahl, 1994), the concept of sign displacement may be explained by the dialectic relation between 'reality independent of our thinking', (metaphysical possibility), and the world that at least partly is a social product (epistemic possibility).

> *Reality independent of our thinking exerts an influence on our ways of thinking about it, but what facts and objects it contains is partially dependent upon the conceptual framework in terms of which we delineate objects and facts within the backdrop of a world. Indeed, according to Peirce "External Fact" can change in accordance with the way human minds "feel, think, or suffer." (ibid.,p. 6)*

Another way of explaining the concept of sign displacement is by contrasting the phenomenological level of signification with the ontological level. As illustrated by the

figure 5:2, it is impossible meaningfully to separate the phenomenological and ontological level. According to Peirce, phenomenology is concerned with all that is in any way or in any sense present to mind.

> *I will not restrict [phenomenology] to the observation and analysis of experience but extend it to describing all the features that are common to whatever is experienced or might conceivably be experienced or become an object of study in any way direct or indirect (CP 5.37)*

The categories of firstness, secondness and thirdnes are fundamental categories of nature and thought and, thus, implicated by the phenomenological categories. However, firstness may be described as the mode of being, or sheer potentiality, secondness the brute facts or particularity, and thirdness successively the possibility of meaning, generality and continuity.

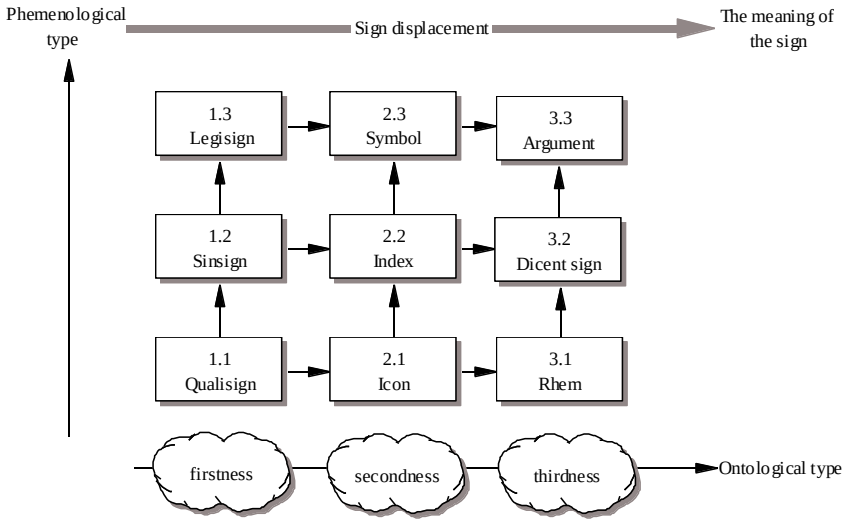


Figure 5:2: The nine types of signs. The figure illustrates the nine types of signs and how they relate. The sign types as trichotomies of firstness, secondness and thirdness (the vertical dimension) provides for the phemenological dimension of the sign system. The lower horizontal line illustrates the ontological type of firstness, secondness and thirdness.

At a meta-level the concept of 'Nature' (see fig. 5:1) is understood as the semeiotic system related to firstness (qualisign, sinsign, legisign). 'Nature' may be perceived as something that has existence by virtue of self-containment and self reference. Nature may analytically be understood as the fundamental pool of semiosis that provides for the possibility of emerging sign systems of more developed kinds.

Secondness (icon, index, symbol) may be understood as the semeiotic system related to 'Man'. Man, or any species emerges from firstness, or in more general terms, matter grows out of the potential of firstness.

Thirdness (rheme, dicent sign, argument) may be understood as the semeiotic system related to culture. Culture emerges from man, and the interpretant is therefore related to cultural activities. Culture is what separate man from beast, by the power of reflection and intelligence. Animals are able to produce symbols – however, man is the only species capable of producing arguments. (cf. Stjernfelt, 2006)

The concept of sign displacement relates to the distance between the category of firstness and thirdness. "*…nature is being displaced through man as an axis of reflection into culture*" (T.Thellefsen, 2002, p. 82).

Thirdness enables man to perceive and speculate about nature, and to generate ideas and theories about the universe.

Furthermore, the semeiotic categories of secondness and thirdness emerge from firstness. For that reason, 'Man' and 'Culture' develops as autonomous complex and even contingent systems not separated, but integrated as a whole. Therefore, we may analytically speak of a representamen as a first; though a genuine sign will always include a first, a second and a third.

Thirdness is the semeiotic category of interpretation that provides observations of objects with a particular meaning; therefore thirdness is a chief principal in any kind of knowledge representation. Discussing knowledge, knowledge systems and their manifestations is eventually a matter of thirdness.

Sowa (1999, p. 61-32) explains the category of thirdness (rhem, dicent sign, argument) by the following example:

1. An individual can be recognized as a human being or as a subtype, such as man or woman, by sensory impressions (Firstness), independent of any external relationships. The type label Woman characterizes an individual by properties that can be recognized without regard to any relationships or other entities.
2. The same individual could be classified relative to many other things, as in the concept types Mother, Attorney, Wife, Pilot, Employee, or Pedestrian. A classification by any of those types depends on an external relationship (Secondness) to some other entity, such as a child, husband, airplane, employer, or traffic.
3. Thirdness focuses on the mediation that brings the first and second into relation. Motherhood, which comprises the act of giving birth and the subsequent period of nurturing, relates the mother and the child. The legal system gives rise to the role of attorney and client. Marriage relates the wife and husband. Aviation relates the pilot to the airplane. The business enterprise relates the employee to the employer. And the activity of walking on a street that is dominated by vehicles relates the pedestrian to the ongoing traffic.

We may speak of inherence, causality and community. The rheme (a first of thirds) has some inherent qualities or properties that are independent of anything else. The semantic label ‘woman’ is characterized by properties that can be recognized without necessary relations to other entities. A woman is a particular that may correspond to the intellectual category ‘woman’, however, the rheme is connected with its object by association of general ideas. Therefore, a rheme includes a symbol, and the rhematic symbol must be a general and, thus, a legisign. Therefore, the semantic label ‘woman’ has particular properties or qualities that relate the semantic label to a particular idea or knowledge of a woman.

The woman may, however, be a mother, which relates the individual to another. Being a mother necessitates a child. Therefore this example shows a dyadic and necessary relation between two entities and is therefore a dicent sign (a second of thirds). The dicent sign is related to a proposition and is affected by its object. It also relates to facts, and thus includes a rhematic symbol.

Formally, the argument (a third of thirds) is the conclusion derived from the proposition suggested. It follows from the previous sign categories that it must be symbolic because it constitutes a synthesis of a rheme and dicent sign, which both are symbolic.

The synthesis addressed as community[33], relates the first and second in a third; "A 'something' in which a community is contained" (Sowa, 1999, p. 61). The concept of motherhood relates the mother and the child. A third is irreducible to a second, and a second irreducible to a first. Motherhood requires both a woman and a child. Apart from the biological perspective, there are also social perspectives that provide norms and values about the concept of motherhood. A mother may be defined as a woman giving birth to a child; motherhood furthermore includes cultural values. Motherhood is, therefore, a general categorization that is defined within a community. In other words, it functions as an idealized cognitive model (ICM).

It is important at this point to consider that the trichotomy of thirdness constitutes a whole and the intellectual property of the sign system. The qualities connected to a rheme relate to an idea forming a particular class, not to objective essences of particulars, as e.g. proposed by Aristotle.

Peirce was not a classical essentialist, even though he spoke of essences. The essence of a class, according to Peirce, relates to the nature of an idea. Peircian essences are of the nature of habit, and habits are subjected to evolution and final causation. To Peirce, the essence of a class is its defining idea, which is its final cause. By a natural class, Peirce means "*a class of which all the members owe their existence as members of the class to a common final cause*." (CP 1.205). Furthermore, Peirce describes the natural class as:

> *Every class has its definition, which is an idea; but it is not every class where the existence, that is, the occurrence in the universe of its members is due to the active causality of the defining idea of the class. That circumstance makes the epithet natural particularly appropriate to the class. (CP 1.214).*

The idea defines a natural class, and the idea of a natural class is shared by the members of a universe of discourse. Furthermore, the defining idea of a natural class motivates the emergence of a community. The idea contains generative life, spreads, and as Peirce

writes in his third Monist article, "The Law of Mind" (1892): the idea "*...tend*[s] *to spread continuously and to affect certain others, but gain*[s] *generality and become*[s] *welded with other ideas*" (CP 6.104) Furthermore, also in "The Law of Mind" Peirce identifies the following elements of an idea: "*the first is its intrinsic quality as a feeling. The second is the energy with which it affects other ideas…The third element is the tendency to bring along other ideas with it*" (CP 6.135). Liszka interprets the spreading of ideas in the following way:

> *The idea of a singular thought, a singular sign, is a fiction; all signs are the result of previous ones, each sign has a history, a tradition behind it. Sign activity is a process, a semeiosis, governed by the principle of synechism or continuity (Lizka, 1996, p. 84)*

The continuous development of ideas is a general and fundamental semeiotic principle. The Dutch Peirce Scholar Meno Hulsvit summarizes Peirce's concept of final cause and natural class in the following way:

> *Peirce's view may be summarized as follows: things belong to the same natural class on account of a metaphysical essence and a number of class characters. The metaphysical essence is a general principle by virtue of which the members of the class have a tendency to behave in a specific way; this is what Peirce meant by final cause. This finality may be expressed in some sort of microstructure. The class characters, which by themselves are neither necessary nor sufficient conditions for membership of a class, are nevertheless concomitant. In the case of a chair, the metaphysical essence is the purpose for which chairs are made, while its having chair-legs is a class character. The fuzziness of boundary lines between natural classes is due to the fuzziness of the class character. Natural classes, though very real, do not exist; their reality is of the nature of possibility, not of actuality. The primary instances of natural classes are the objects of scientific taxonomy, such as elementary particles in physics, gold in chemistry, and species in biology, but also man-made objects and social classes. (Hulswit, 2002, p. 132)*

Consequently, by *final cause* Peirce meant the general principle according to which members of a class tend to behave. Classification must be related to a purpose, which is its cause. As proposed by Hulswit, Peirce's view may be understood as causal pluralism.

> *…by denying that final causes are static, unchangeable entities, Peirce avoided the problems attached to classical essentialism […] by eliminating arbitrariness, Peirce also avoided pluralistic anarchism. (ibid, p. 132)*

By denying that final causes are static, and acknowledging the proposition of Hulswit that Peirce's view may be understood as Peirce's causal pluralism, we may consider concepts of any kind as the intellectual property of a class.
The category of thirdness (the category of the interpretant) represents the intellectual capacity of relating perceived objects of any kind to general concepts.
In the next section, I will explain in further detail how the interpretant functions as a relative between a sign (representamen) and an object, and how we may argue for causal pluralism without giving in to relativism, and how this relates to subject representation in KOS.

5.2 Peirce's interpretants revisited

As discussed in the previous chapter, the interpretant is the most distinctive and innovative feature of Peirce semeiotic. The interpretant is what we understand as the meaning of the sign/object relation (Atkin, 2006). The sign process starts with the object, the object determines the sign. However, as one may imagine, the object in its totality includes distinctive features that are more or less relevant for the signification process. For instance, 'a book' (representamen) may signify a book (object) by particular distinctive features as e.g. being a physical entity containing pages with writing, having an author, a title, a publisher etc. Of minor importance for identifying a book as a book is for instance its color, genre, type of paper used, its subject, quality of

the text etc. These features are, however, also important features of the object. The point is that the meaning of a sign depends on relevant features. A sign or a concept reduces the complexity of an object by addressing particular relevant characteristics; consequently, an object may be multifaceted complex and simultaneously take part in different signification processes.

In Peirce's late semeiotic, and as a consequence of the mature scholastic realist Peirce developed into, the object is divided into 'the immediate object' and 'the dynamical object'. The relation corresponds to the example above, the book in its totality constitutes the dynamical object – however, the distinctive features that signify the object constitutes the immediate object. The immediate object is therefore the object as it appears at any point in semiosis, the 'real object', i.e. the dynamical object, is the object as it really is. This distinction is important, because the immediate object is provisionary and may involve some erroneous interpretations of the dynamical object.

The interpretant determines the meaning or understanding we reach of a sign/object relation. Still, *"... the sign signifies its object only in virtue of some of its features. Additionally, the sign determines an interpretant by focusing our understanding on certain features of the signifying relation between sign and object."* (Atkin, 2006)

In his later works, Peirce elaborates on the function of the interpretant and three trichotomies are of particular interest: Firstly, as stated above, the interpretant is divided into 'the immediate interpretant', 'the dynamical interpretant' and 'the final interpretant'. In "Prolegomena to an Apology for Pragmaticism" (1906), Peirce describes the interpretants in the following way:

> *In regard to the Interpretant we have [...] to distinguish, in the first place, the Immediate Interpretant, which is the interpretant as it is revealed in the right understanding of the Sign itself, and is ordinarily called the meaning of the sign; while in the second place, we have to take note of the Dynamical Interpretant which is the actual effect which the Sign, as a Sign, really determines. Finally there is what I provisionally term the Final Interpretant, which refers to the manner in which the Sign tends to represent itself to be related to its Object. (CP 4.536)*

Peirce here describes a distinction of the interpretant at a general level of semiosis, which constitutes the formal conditions for the signification process.

In other words, the immediate interpretant is defined as the total unanalyzed effect that a sign produces on a perceiving mind. The immediate interpretant is an abstraction, consisting in a possibility. The immediate interpretant of a sign, for instance of a term, would be a mind's recognition of it as being a term (a rhem). The immediate interpretant is *"…all that is explicit in the sign itself apart from its context and circumstances of utterance."* (CP 5.473).

The dynamical interpretant is the actual effect produced by a sign on a perceiving mind (CP 8.343). It is our understanding of the sign at some instance in the semeiotic process (Atkin, 2008). The dynamical interpretant relates to actualization, to events that occur, which may provoke physical or mental action. Peirce describes the dynamical interpretant as the "*effect actually produced on a mind*" (CP 8.343), or as the "*actual effect which the sign, as a sign, really determines*." (CP 4.536)

The final interpretant is described as *"that which would finally be decided to be the true interpretation in consideration of the matter were carried so far that an ultimate opinion were reached."* (CP 8.184). The final interpretant, then, is our understanding of the dynamical object, the end of inquiry, that is, if we had reached a true understanding of the dynamic object. Peirce's notion of inquiry is clearly central here.

Atkin (2008, p. 69), summarizes the elements of the sign and signification in Peirce's final account of signs as follows:

1. the sign
2. the dynamical object
   (the real object as it is known at the end of inquiry)
3. the immediate object
   (the object suggested by current understanding, and generated by previous dynamic interpretants)
4. the immediate interpretant
   (our general understanding of form, or syntax, of the sign)
5. the dynamic interpretant

(the actual understanding of the dynamic object at some interim stage in the semeiotic chain/process)

6. the final interpretant

   (the understanding of the dynamic object at the end of inquiry)

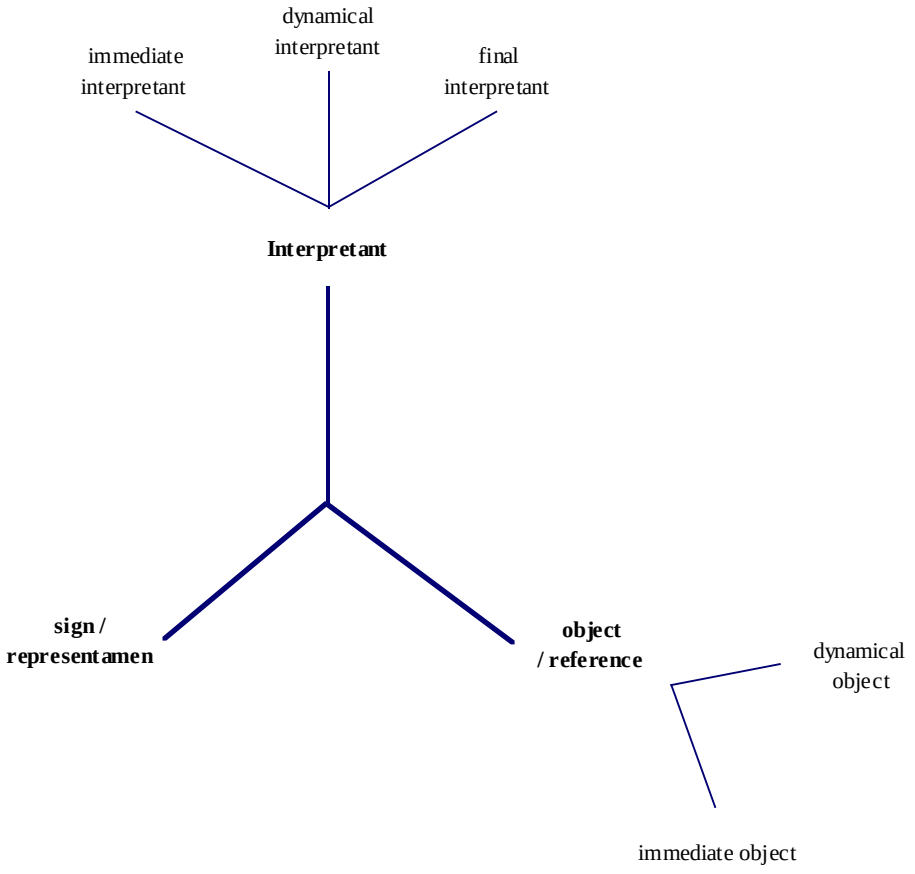


Figure 5:3: The dynamics of the sign: The figure summarises the constituents of the sign. The object determines the sign/representamen, and is divided into immediate and dynamical object. The interpretant which is the meaning of the sign is divided into immediate, dynamical and final interpretant.

The second trichotomy, that functions at the level of cognition, divides the interptetant into 'the emotional interpretant', 'the energetic interpretant' and 'the logical interpretant'. This trichotomy may be considered as a specification of the dynamical interpretant[34]. This interpretation is, however, disputed by Liszka (1996), who argues

that the divisions of the interpretant are relatively synonymous or analogous. The advantage of Liszka's argument is that it is true to the systemacy of firstness, secondness and thirdness (see table 7). And as a consequence, we may consider the three elaborations of the intepretant as different analogous levels of abstractions.

> *In all cases [the Interpretant] includes feelings; for there must, at least, be a sense of comprehending the meaning of the sign. If it includes more than mere feeling, it must evoke some kind of effort. It may include something besides, which, for the present, may be vaguely called "thought". I term these three kinds of interpretant the "emotional", the "energetic", and the "logical interpretants." (EP 2.409)*

The emotional interpretant relates to quality, a feeling, the energetic interpretant relates to action, and the logical interpretant relates to a proposition.

> *There is almost always a feeling which we come to interpret as evidence that we comprehend the proper effect of the sign, although the foundation of truth in this is frequently very slight. This "emotional interpretant," as I call it, may amount to much more than that feeling of recognition; and in some cases, it is the only proper significate effect that the sign produces. (CP 5.475)*

Peirce uses the example of music to demonstrate the emotional interpretant. The emotional interpretant may, however, cause an effect - for instance, listening to music may generate associative images, awaken past experiences. The logical intepretant is the meaning of the sign.

> *[The energetic interpretant] never can be the meaning of an intellectual concept, since it is a single act, [while] such a concept is of a general nature. But what further kind of effect can there be?*
> *In advance of ascertaining the nature of this effect, it will be convenient to adopt a designation for it, and I will call it the logical interpretant, without as yet determining whether this term shall extend to anything*

> *beside the meaning of a general concept, though certainly closely related to that, or not. Shall we say that this effect may be a thought, that is to say, a mental sign? No doubt, it may be so; only, if this sign be of an intellectual kind -- as it would have to be -- it must itself have a logical interpretant; so that it cannot be the ultimate logical interpretant of the concept. It can be proved that the only mental effect that can be so produced and that is not a sign but is of a general application is a habit-change; meaning by a habit-change a modification of a person's tendencies toward action, resulting from previous experiences or from previous exertions of his will or acts, or from a complexus of both kinds of cause. It excludes natural dispositions, as the term "habit" does, when it is accurately used; but it includes beside associations, what may be called "transsociations," or alterations of association, and even includes dissociation, which has usually been looked upon by psychologists (I believe mistakenly), as of deeply contrary nature to association. (CP 5.475-6)*

Peirce here defines the logical interpretant as the meaning of a general concept. It is an intellectual sign, but it is not the ultimate meaning as suggested by the final interpretant. Consequently, I consider the logical interpretant the provisionary meaning of intellectual concepts.

A third trichotomy divides the interpretant into ‘the intentional interpretant’, ‘the effectual interpretant’, and ‘the communicative interpretant’ (or cominterpretant). The third trichotomy relates the interpretant to the process of communication.

> *There is the Intentional Interpretant, which is a determination of the mind of the utterer; the Effectual Interpretant, which is a determination of the mind of the interpreter; and the Communicational Interpretant, or say the Cominterpretant, which is a determination of that mind into which the minds of utterer and interpreter have to be fused in order that any communication should take place. This mind may be colled the commens. It consits of all that is, and must be, well understood between utterer and interpreter, at the outset, in order that the sign in question should fulfill its function. (SS 196-7)*

	Firstness	Secondness	Thirdness
Signification	Immediate interpretant	Dynamical interpretant	Final interpretant
Cognition	Emotional interpretant	Energetic interpretant	Logical interpretant
Communication	Intentional interpretant	Effectual interpretant	Cominterpretant

Table 7: Three analytical levels of the interpretant

This elaboration of the sign structure provides for some interesting aspects which is relevant for KO. Firstly, the relation between the immediate object and the dynamical object suggests that the immediate object expresses a partial understanding of the dynamical object. Secondly, where the immediate interpretant is the syntax or general feature of a sign, the dynamical interpretant is our understanding of the sign at some instance in the sign process. The dynamical interpretant is therefore an actual understanding of the dynamical object at some interim stage of inquiry; it provides an incomplete understanding of the dynamical object.

> *Immediate objects, then, are accumulative and inferential, and are connected to each other by more than sharing a dynamic object; they represent different stages of understanding in the same information gathering process. (Atkin, 2008, p. 74)*

The final interpretant is the interpretant that will remain unchanged during any further investigation and interpretantion. The final interpretant is thus the final understanding of the dynamical object at the end of enquiry; consequently, the determination of the dynamical object implies a series of dynamical interpretants and immediate objects.
In relation to KOS's, the immediate level of the interpretant, expresses the formal structure of the system. We may for instance distinguish term lists from classification systems and thesauri. The dynamical interpretant as stated by a subject indicator is the

actual but incomplete determination of the dynamic object at some interim stage in the semeiotic chain/process, and consequently dynamical interpretants constitute immediate objects. The final interpretant would be the stage where the immediate and dynamical object becomes one. The final interpretant thus stands for the dynamical object, and at the end of enquiry it would be the final meaning of a concept. Within science, the final interpretant would be the true relation between sign and object. One may argue that the final interpretant is beyond reach because scientific theories are continuously modified. Therefore, the final interpretant is rather the telos of the signification process. According to Peirce, science develops according to an ideal, which is the final interpretant, and, thus, from this perspective, Peirce considers science progressive.

From the perspective of KOS, the final interpretant would be considered the true relation between subject representations and the subject itself as determined by the scientific community.

The division of the interpretant into the trichotomy of immediate, dynamical and final interperetant provides a formal and general explanation of the different stages in the signification process. The final stage, which is the final interpretant, expresses the telos towards which end the signification process may turn at the end of inquiry.

> *My Final Interpretant is […] the effect the sign would produce upon any mind upon which the circumstances should permit it to work out its full effect.*
> *[…]*
> *…the Final Interpretant is the one Interpretive result to which every Interpreter is destined to come if the Sign is sufficiently considered. […] The Final Interpretant is that towards which the actual tends. (SS 110-111)*

The second trichotomy divides the interpretant into the emotional, the energetic and the logical interpretant, and is considered from the perspective of an interpreting mind, thus, relating the signification process to thought. Consequently, the logical interpretant is the meaning of an intellectual concept (CP 5.476; 5.480-6). The meaning of an intellectual concept emerges through the stages of the emotional interpretant and the energetic

interpretant; within science, it could be an idea, a hunch, that is motivated by an object (a phenomenon) that develops and becomes manifest, and eventually becomes fixated in a concept which is the logical interpretant. Accordingly, the logical interpretant follows the trajectory of the final interpretant that is the ultimate end of discovery.

Subject representations are logical interpretants. However, subject representations may be motivated by other interests than the final interpretant of a particular scientific concept. Therefore, the meaning of subject representations may deviate from the scientific meaning that is defined and grounded in the scientific community.

The third division of the interpretant, the trichotomy of intentional, effectual and cominterpretant, is considered from the perspective of communication.

As is the case with the roadmap, a model or representation includes a perspective and a purpose. I consider the concept of causal pluralism as mentioned in the previous section to apply to that phenomenon. An object may motivate different kinds of representations that relate to different purposes. There are many legitimate ways of dividing the world into categories and kinds. Accordingly, a classification as suggested by a particular KOS unites objects that share a particular resemblance, and scatter unlike objects. However, what is like and unlike is not absolute, but relates to the purpose and perspective of the classification.

Because an object can be represented or classified differently by selecting different qualities of the object, a subject representation communicates a particular meaning. Consequently, concepts that are developed and expressed by terminology within a particular community communicate a specified meaning which is unique and presuppose a particular specialized knowledge. The function of terminology is to label this specialized knowledge. The meaning communicated by a subject representation presupposes a deliberate intention. Additionally, an interpreting mind expects a particular meaning signified by the representation which of course is based in domain knowledge. We may consequently speak of different kinds of interpretants that relate to the communication process.

5.2.1 The intentional, the effectual and the communicative interpretant

In relation to communication, and in particular in relation to KOS's, the 'intentional interpretant', 'effectual interpretant' and 'communicative interpretant' are of interest, because they address the communicative relation between an utterer and an interpreter. The utter, in the case of a KOS, represents an intended meaning by means of a subject representation.

The meaning of a subject representation consequently depends on what Peirce calls 'the commens', or communicative interpretant (or just cominterpretant).

The cominterpretant is based in collateral experience, meaning, for instance that if an utterer communicates a particular concept to an interpreter, the communication process will depend on the experience of the interpreter. If the communication is to be a success, the utterer and interpreter are required to share the same symbolic system of representation, say scientific language, and collateral experiences.

From the perspective of KOS, we may consider the subject representations of a KOS as logical interpretants that reflect a particular structure and meaning of the dynamical object.

Considering the success of a KOS by its ability to establish a cominterpretant (or in LIS terms provide relevant documents), thus depends on a match between different sign systems.

A subject representation that is considered an intentional interpretant, stated by a KOS, communicates that particular documents fall under a particular subject category, and may be described by a particular subject indicator.

The effectual interpretant relates to how a perceiving mind understands the meaning of a subject indicator.

The communicative interpretant is the ultimate effect of signification, where the intentional meaning and the effect produced in a perceiving mind is identical. The communicative interpretant consequently represents the stage in a communicative process where an utterer and a perceiver share a common understanding of an object communicated by means of a shared terminology. This last statement summarizes the major challenges of KOS.

5.3 Summary

The function of the interpretant is to establish a connecting bond between a representamen (a sign) and its object. The interpretant is the meaning of the sign relation; however, the interpretant also establishes a displacement between a sign and its object, because the interpretant is considered the intellectual and-/or habitual property of the sign process. Consequently, the relation between a sign and its object is not absolute, but motivated by a particular mindset or cultural understanding, and of course by the object itself.

A KOS establishes a connection between a user and a database of document representations; however, the subject indicators structured within a KOS may be more or less appropriate according to the perspective of users.

This phenomenon may be explained semeiotically by means of the interpretant. According to Peirce, the interpretant can be divided into the immediate interpretant, the dynamical interpretant and the final interpretant. The immediate interpretant relates to structure, the dynamical interpretant to provisionary meaning, and the final interpretant to the final meaning of the sign, at the end of inquiry. However, this division of the interpretant constitutes only the formal properties of the signification process.

A second division of the interpretant, the emotional, the energetic and the logical interpretant, relates to the process of cognition, and, accordingly, a concept is considered a logical interpretant and is defined as the meaning of an intellectual concept. The logical interpretant is in this case the concept as it is formed, discussed and understood within a community; its representation in a KOS constitutes a fixation that establishes a particular understanding of a concept. However, the subject representation provided by a KOS represents an immediate object. This distinction is what is meant by sign displacement in KOS. From the perspective of semeiotic, the objects represented by KOS's are not genuine concepts, but replicas of concepts that interpret a particular meaning of a dynamical object which for some users may be considered correct, but which may be considered faulty or misleading by other users.

In this chapter I have explored the function of the interpretant in Peirce's semeiotic; I have elaborated on the interpretant and discussed it in relation to subject representation,

and I have explained how KOS's establishes or instantiates a replica of subject categories that relate to the dynamical object of a subject, which again is formed and developed within communities.

In the next chapter I will analyze the interoperability of cognitive semantics and Peirce's semeiotic theory. In chapter 3, cognitive semantics was related to cluster analysis and Peirce's semeiotic theory to the historical approach. The question remains to investigate whether these theories are incommensurable. The historical approach does not disregard or exclude clusters, as elements in concepts, but instead of empirical qualitative similarity, priority is given to scientific explanations. The historical approach may thus explain the occurrence of clusters or graded categories.

6 Developing the dynamical communication model

Introduction

In chapter 3, three philosophical approaches to concept theory was discussed: essentialism, cluster analysis and the historical approach. It was argued that cognitive semantics, as formulated in (Lakoff, 1987; Lakoff & Johnson, 1999), is related to cluster analysis. However, the concept cluster analysis is, in the terms of (Ereshefsky, 2001) understood in a broader sense than mere statistical clusters, and includes concepts which cannot be defined exclusively by necessary and sufficient properties, as fuzzy conceptual categories, prototypes and idealized cognitive models (ICM). It is also stated that linguistic phenomena as metaphor and metonymy play an important role in communication and representation. The historical approach emphasizes the importance of causal relations, and downplays the significance of qualitative similarity. Qualitative similarity is important, but causal and genealogical explanations are considered even more important.

Chapter 4 and 5 introduced Peirce's semeiotic theory and the concept of sign displacement. Sign displacement is considered an interpretive distance made by the interpretant that goes between nature and our understanding of nature. In this perspective, reality cannot be perceived neutrally or objectively, but only mediated, and understanding is thus influenced by perceptive abilities, theories and pre-understanding.

In this chapter, the cognitive semantic approach is revisited and analyzed from the perspective of semeiotic theory. The ideas of ICM, basic level concepts, metaphors and metonymy are important reasoning mechanisms, and, as suggested by Lakoff, these reasoning mechanisms form central parts of human cognitive capacity. Even though Lakoff argues in favor of experiential realism, reality can only be perceived by means of these reasoning capacities, which additionally are biased by language, culture, pre-understanding and interests. These cognitive mechanisms and social circumstances are not disregarded by Peirce's semeiotic theory; however, Lakoff seems to reproduce a

dualism (even though Lakoff rejects Cartesian dualist metaphysics!) between reality and perceived reality, or, more precisely, by arguing that our knowledge about reality is motivated by external reality, but also distanced from it. Concepts and categories are embodied and, in other words, the knowledge about the world is rooted in experience.

Peirce metaphysics argues in favor of a dialectic relation between reality and perceived world. What provides the perceived world with a telos is the independent reality, and our knowledge may be biased by cognition, pre-understanding, culture, theories, etc., however ideally reality corrects our knowledge about it in the long run. Lakoff's concept of reality may thus seem incompatible with Peirce's metaphysics; however, the functions of basic level categorization, metaphor and ICM may also be seen as processes of signification, and related to the interpretant.

The discussion of cognitive semantics and semeiotic theory leads to the development of the concept 'significance effect'. Significance effect is thus considered an effect of meaning, where concepts at a basic level provide for the most inclusive level of understanding about category members. The concept of significance effect is developed further and eventually seen within the context of communication, and the communication model, 'the Dynacom', is proposed as a semeiotic communication model joining together the notion of basic level categorization, metaphor and ICM, at the level of the interpretant.

6.1 Cognitive semantics and semeiotic theory – can they work together?

As proposed by Lakoff, cognitive semantics provides for an alternative view on human cognition and language formation. It is anti-reductionistic, it opposes the strict formalization of cognitive science, and it is, furthermore, pragmatic in the sense that concepts are situated and purposeful. Additionally, cognitive semantics relates concepts, categories and meaning making to the embodied mind. Any kind of knowledge relates to the human capacity of sensing and categorization. Categorization is thus considered a cognitive pre-linguistic ability that provide for a particular kind of organization. However, actualizations of categories are culture-dependent. As discussed above, the concepts 'bachelor' and 'mother' are highly culture-sensitive concepts. Scientific

concepts are similarly dependent on context and use. They may be organized around a basic level category, and express a particular ICM that may be organized around a prototype, see (Bryant, 2000; Kertesz, 2004; Temmerman, 2000).

Cognitive semantics thus argues fiercely against objectivist philosophies of categorization. Concepts do not comprise to a fixed set of necessary and sufficient conditions, and involves more than matching a list of attributes. Lakoff speaks of embodied realism, instead of disembodied or neutral realism, in terms of absolute truth, and, most importantly, Lacoff's critique dismisses logic and mathematics as neural and disembodied modes of reasoning (Lakoff & Johnson, 1999; Lakoff & Núñez, 2000).

Embodied realism believes that 1) there is a world independent of our understanding of it, and 2) we can have stabile knowledge of it. However, our concepts and reasoning and, thus, knowledge about the world are characterized by our brains and bodies (Lakoff & Johnson, 1999).

As discussed within the semiotic section, Peirce's semeiotic theory is derived from logic. Logic is the governing principle of Peirce's semeiotic categories, and thus seems incompatible with cognitive semantics that reject traditional logic and objectivist rationality as appropriate tools for linguistic analysis. However, even Lakoff needs logic in order to establish distinctions between categories, even if categories are graded - how is membership confirmed if not by some kind of fuzzy logic? Lakoff's critique against logic relates to essentialism and absolute truth.

As is the case with Lakoff, Peirce emphasizes the importance of community in which meaning of language becomes fixed and gradually more stabile.

Furthermore, both Lakoff and Peirce would agree that the meaning of any linguistic sign can only be fully understood in terms of how it is meaningful in practice.

Lakoff claims that cognitive semantics is in accordance with basic realism, which he describes by the following statements:

> *Basic realism involves at least the following:*
> *a commitment to the existence of a real world, both external to human beings and including the reality of human experience*

> *a link of some sort between human conceptual systems and other aspects of reality*
> *a conception to truth that is not merely based on internal coherence*
> *a commitment to the existence of stable knowledge of the external world*
> *a rejection of the view that "anything goes" – that any conceptual system is as good as any other.*
> *(Lakoff, 1987, p. 158)*

Lakoff claims his position to be experientialist, based on the cognitive capacities described above, and thus incompatible with any metaphysics that provide a strict dualism between human understanding and the nature of the world.

Furthermore, categorization is a cognitive capacity that is part of human nature: Even though categories may be in accordance with the classic view, they exist along with prototype categories, and both are products of human mind and important for cognition. However:

> *To say that classical categories are an invention (an important invention) of the human mind is not to say that no classical categories really exist. Certainly it is possible to create artificial categories of things to fit our cognitive models. It may even be the case that some classical categories do exist in nature. The point is that not all categories – either of mind or of nature – are classical, and therefore we cannot assume, a priori, as objectivist metaphysics does, that all of nature is structured by classical categories. (Lakoff, 1987, p. 160)*

Lakoff argues against objectivist metaphysics - concepts are cognitive models that may fit reality, but we have no way of determining whether our concepts actually correspond to some natural kind. The only access to nature is by experience, and our cognitive models are thus motivated by experience and modified by human cognitive ability, social and cultural habits, and language.

As described by Lakoff, the ICM is based in culture, particular concepts as e.g. 'Mother' and 'Bachelor' may be understood and defined differently in different cultures. Different cultures may emphasize diverse values when describing concepts,

and therefore an ICM correspond to a culture contingent reality. As pointed out by Lakoff, the ICM is a concept in actu, the meaning of an ICM relates to its use within culture. Furthermore, an ICM may organize categories according to a prototype, i.e. family resemblance.

Even though Peirce never discusses graded categories, the Icon may provide for this kind of reasoning. The Iconic relation between a sign and an object is related by means of similarity. This similarity may be abductive, metaphorical and possible, but not necessarily probable or true. We may thus argue that the members within prototypical categories are related by means of Icons. Essentialist categorization determined by necessary and sufficient conditions is on the other hand based on inductive and deductive logic which resemble the indexical mode of reasoning.

In summary, we may argue that Peirce and Lakoff share similarities regarding rejecting absolutism and Cartesian metaphysics. Also, both cognitive semantics and pragmatic semeiotic emphasize the importance of social and cultural activity. They differ with regard to their claims of realism. Experiential realism, or embodied realism, as claimed by Lakoff (1987), agrees with traditional dominant views that are committed to the existence of a real world, that recognizes that the real world restrains our conception of it, that truth is conceived as something that goes beyond mere internal coherence, and that acknowledges the existence of stabile knowledge of the external world. However, experiential realism holds, in contrast to the dominant traditional views, that human reasoning is only possible by means of the body, and that reasoning grows out of the nature of the organism and that all this contributes to its individual and collective functioning.

> *Experientialism is thus defined in contrast to objectivism, which holds that the characteristics of the organism have nothing essential to do with concepts or with the nature of reason. On the objectivist view, human reason is just a limited form of transcendental reason. The only roles accorded to the body are (a) to provide access to abstract concepts (b) to provide "wetware," that is, a biological means of mimicking patterns of transcendental reason, and (c) to place limitations on possible concepts and forms of reason. On the experientialist view, reason is made possible*

> *by the body – that includes abstract and creative reason, as well as reasoning about concrete things. Human reason is not an instantiation of transcendental reason; it grows out of the nature of the organism and all that contributes to its individual and collective experience: its genetic inheritance, the nature of the environment it lives in, the way it functions in that environment, the nature of its social functions, and the like. (Lakoff, 1987, p. xv)*

According to Lakoff & Johnson (Lakoff & Johnson, 1999), truth depends on understanding, which means that truth related to embodiment is never objective and absolute, but is not subjective either, but relative to the function of general human perception. "*Because we all have pretty much the same embodied basic-level and spatial-relations concepts, there will be an enormous range of shared "truths," as in such clear cases as when the cat is or isn't on the mat.*" (Lakoff & Johnson, 1999, p. 107)

Peirce's realism is closely related to his pragmatic maxim and is therefore often referred to as pragmatic realism cf. (Skagestad, 1981). Also, Peirce's conception of realism is dynamic. The object of a sign can never be fully exhausted by the interpretant, but only aproximated by means of immediate objects.

> *We must distinguish between the Immediate Object, -- i.e. the Object as represented in the sign, -- and the Real (no, because perhaps the Object is altogether fictive, I must choose a different term, therefore), say rather the Dynamical Object, which, from the nature of things, the Sign cannot express, which it can only indicate and leave the interpreter to find out by collateral experience* (CP 8.314)

As a consequence, reality may be approximated by means of inquiry (the pragmatic maxim), however, never fully reached.

Peirce's semeiotic theory provides for a deeper and more comprehensive theory of cognition than Lakoff's. An important achievement of Lakoff is that he addresses the function and interdependencies of language and cognition in a very direct manner. However, the basic realism or experientalism suggested by Lakoff has a tendency

towards a kind of subjective empiricism (Mammen, 1994). How would Lakoff explain generality and continuity?

According to Michael Haley:

> *A genuine communion of thoughts and feelings between different minds (and not just between human minds, either!) is not only possible but is actually reliable because of the inherently analogical structure of thought and feeling. It is not that I can ever know for sure that my own visual/mental experience of 'red' is exactly like yours; but what I can know, if I can know anything at all, is that 'red' must occupy in your visual/mental experience a place that is reliably analogous to the place it occupies in mine. Note that Peirce even extends the confidence he has in such analogies to one form of metaphor – synesthesia (the blind man's imagination of 'red' as 'the blare of a trumpet'). More than anything else, however, what makes such analogies between different mental experiences reliable is their groundedness in a larger analogy – the cognitively foundational analogy between the human mind and external nature. In short, to whatever extend we really are capable of understanding nature, it is only because our minds are like nature. And it is only within the context of this large likeness that we are capable of understanding ourselves and one another – which includes expressions of our thoughts and feelings to one another through poetry, music, and ordinary conceptual metaphor. (Haley, 1997, p. 434)*

In other words, our concepts and categories are motivated by the same external nature that we as human beings ourselves are a part of. Consequently the structure of external nature is analogue to the structure of mind, which may explain why we can communicate confidently and agree about external objects.

Therefore, the dualism between nature and our understanding of nature reproduced (even though he argues against it) by Lakoff, is nullified by Peirce's analogy. External space and mind-space ultimately belong to one and the same continuum (Haley, 1997).

For Peirce, image schemata are important for any language. Any language would need temporal relations, spatial relation (Lakoff's container metaphor and kinesthetic scheme) and metaphor.

> *If a logician had to construct a language de novo--which he actually has almost to do--he would naturally say, I shall need prepositions to express the temporal relations of before, after, and at the same time with, I shall need prepositions to express the spatial relations of adjoining, containing, touching, of in range with, of near to, far from, of to the right of, to the left of, above, below, before, behind, and I shall need prepositions to express motions into and out of these situations. For the rest, I can manage with metaphors. (CP 2.290 footnote P1)*

According to Peirce, the metaphor is the cognitive ability to unite different conceptual expressions into new expressive forms. It resembles the metaphor of Lakoff, and is considered, as indicated by the quotation above, an important cognitive mechanism.
Metaphor is not just a rhetorical trope; it is a fundamental conceptual or cognitive mechanism, and furthermore:

> *… metaphor goes beyond human language… in expressing and embodying relationships that are fundamental to human thought and consciousness. (Haley, 1997, p. 422)*

And,

> *Metaphor […] embodies a peculiar sort of relationship between things; namely, it involves understanding one thing in terms of another thing of a different kind. (ibid, p. 422-423)*

However, a difference between Peirce and Lakoff may be identified in how they relate metaphors to embodiment. Even though Lakoff defines his epistemology as experiental realism, it is primarily related to culture. Even though Lakoff defines the mechanisms of cognition as pre-linguistic, language is formed by culture and related to a conventionalized use. The metaphor is for instance related to the kinesthetic scheme, and whether the feeling of happiness relates to ‘up’ or ‘deep’ which are metaphorical opposites, is culturally motivated.

Peirce defines his understanding of the metaphor as a hypericon.

> *Hypoicons may be roughly divided according to the mode of Firstness of which they partake. Those which partake of simple qualities, or First Firstnesses, are images; those which represent the relations, mainly dyadic, or so regarded, of the parts of one thing by analogous relations in their own parts, are diagrams; those which represent the representative character of a representamen by representing a parallelism in something else, are metaphors. (CP 2.277)*

The metaphor as a cognitive mechanism is based on structural analogy. Furthermore, the metaphor is related to the logic of abduction, thus, providing for the ability to generate new insights by means of parallelism. The metaphor may thus be understood as a possible relation of new meaning.

> *The abductive suggestion comes to us like a flash. It is an act of insight, although of extremely fallible insight. It is true that the different elements of the hypothesis were in our minds before; but it is the idea of putting together what we had never before dreamed of putting together which flashes the new suggestion before our contemplation. (CP 5.181)*

Even though Peirce did not provide for a comprehensive theory of metaphor, it is obvious that the idea of metaphorical reasoning is related to the logic of abduction because it blends different cognitive schemes and provides for new insights.
However, unlike Lakoff, an apparent consequence that may be deduced from Peirce is that the metaphor is not just a cultural or socially contingent phenomena, it is rather a mechanism that stands in relation to an external Mind. Consequently, the metaphor may reveal real and true structural affinities between an object and the interpretant. Scientific concepts may reflect reality because there is a structural analogy between the categories of the mind of the subject and the categories of reality. Peirce thus believes that true knowledge is possible in the long run.

> *...human opinion universally tends in the long run to a definite form, which is the truth. Let any human being have enough information and exert enough thought upon any question, and the result will be that he will arrive at a certain definite conclusion, which is the same that any other mind will reach under sufficiently favorable circumstances. [---] There is, then, to every question a true answer, a final conclusion, to which the opinion of every man is constantly gravitating. He may for a time recede from it, but give him more experience and time for consideration, and he will finally approach it. The individual may not live to reach the truth; there is a residuum of error in every individual's opinions. No matter; it remains that there is a definite opinion to which the mind of man is, on the whole and in the long run, tending. (CP 8.12)*

This line of thought is different from Lakoff's cognitive semantics. Theoretically, Lakoff remains within the realm of cultural relativism. According to Lakoff, concepts and the meaning they provide, are embodied, language dependent and formed by culture.

Lakoff claims experiental realism, and ties this to the cognitive abilities of Man; the meaning of language and categorization simply resides in embodied experience. There exists no objective, disembodied truth, thus, the world is not mirrored by language.

> *Experientialism is Lakoff's basis for rejecting the doctrine of 'metaphysical realism' ([Laskoff],p. 260), in which reality is independent of human embodiment; on the other hand, the 'realism' component rescues him from the solipsism of 'total relativism'. (Edwards, 1991, p. 531)*

Peirce would argee that experience and culture matters, as he formulated as the first of his cotary propositions: "*Nihil est in intellectu quod non prius fuerit in sensu*." (CP 5.181) However, Peirce considers reality independent of human cognition. What is real is not a matter of human thought; human thought is contrarily analogous to reality, and correctible by future experiences. Even though we may speak of structural affinities between a sign and an object, it is only by means of interpretation – the function of the interpretant – that this relation is maintained.

> *In short, to whatever extent we really are capable to understand nature, it is only because our minds really are like nature. And it is only within the context of this large likeness that we are capable of understanding ourselves and one another – which clearly includes the expression of our thoughts and feelings to one another through poetry, music, and ordinary conceptual metaphor. (Haley, 1997, p. 435)*

Seeing mind and reality as structurally bounded and analogous, refutes the dichotomy between external reality and perceived reality.

Lakoff's concept of embodiment places the focus on human perceptive abilities, and, as a consequence, concepts and knowledge about reality are biased by our senses and the modus operandi of the body. In Lakoff's terms, knowledge will therefore always be circumstantial and relative to embodiment and culture.

Peirce would on the other hand argue that the structural affinity between reality and mind means that knowledge, however provisionary it may be, also includes the possibility of being relatively stable and true.

From this analysis, Lakoff's cognitive semantics is more related to constructivist theories than realist theories and Peirce vice versa. In other words, in Lakoff's terms, reality is constructed by human perception. It may be independent of human thought, but our understanding of reality goes though embodied reasoning. In Peirce's terms Man is nature, and the thought of man is analogous to the thought of nature. Our knowledge about reality is mediated by signs, and signs are based in the phenomenological categories of firstness (potentiality), secondness (actuality) and thirdness (continuity).

I will not take this discussion any further, but just summarize that the realism claimed by Peirce and Lakoff is fundamentally different, and regarding the status or truth value of concepts and knowledge their views are incompatible. However, from the perspective of semeiotic there are some interesting aspects involved in Lakoff's notion of basic level categorization, metaphor and ICM. This will be the area of discussion in the next section.

6.2 Stating the concept of significance-effect

Based on the theoretical discussion above, concepts can be considered more or less significant within a community. Apparently important concepts such as 'information', 'knowledge' and 'media' are highly significant concepts within the field of LIS, and the approach toward these significant concepts differs from other domains that may define the same concept in a different context with different perspectives and meanings.

As discussed above, concepts are context dependent, and may, even though related, demarcate a particular disciplinary interest which is of minor interest within other disciplines.

Basic level categorization provides for a hierarchical organization within categories. A 'chair' is considered a basic level category, where 'furniture' is more inclusive and thus a superordinate category and 'rocking chair' is a more specific category of chairs, and thus a subordinate category. In section 3.2.1 basic level categorization was reviewed and it was argued that even though basic level categorization is connected to experience, abstract concepts may follow a similar mode of categorization.

Superordinate level	Knowledge	Information	Text
Basic level	Knowledge organization	Media	Document
Subordinate level	Different kinds of representation systems	Different kinds of media products	Different kinds of documents, types, genres etc.

Table 8: Examples of basic level categorization within LIS concepts

Table 8 provides for some examples of basic level categorization within LIS, however, these examples are also very general, and, it may be difficult to establish the same structuring principles at a more advanced level, at least with reference to Lakoff's definition of basic level (see p. 65-66). It seems meaningless to argue that 'bibliometry' and 'information architecture' are basic level concepts. Of course we may relate 'bibliometry' to 'empirical methods' and 'statistics', we may also be able to exemplify

subordinate levels of the concept, e.g.: 'co-citation analysis', 'bibliographical coupling', etc., however what becomes evident is that the definitions provided by such abstract concepts depends on acquired knowledge, and is cannot alone be reduced to a simple matter of ostentation, mental images and motor movements.

When speaking of abstract concepts, and in particular technical terms, categorization therefore depends on what is already known by the interpreter (in semeiotic terms: collateral experience). Even though Lakoff's definition works well when speaking of actual objects as e.g. furniture or cats and dogs, when related to abstract concepts the definition needs to be modified.

In relation to metaphor, I provided some examples of metaphors in section 3.2.5, metaphor is a cognitive mechanism that structures a particular understanding of an expression. Metaphors are paramount also in technical language, and functions as a delimitation of a cognitive space (universe of discourse). A metaphor is a parallelism that transfer meaning between to unrelated domains, thus motivating new perspectives and modes of reasoning. In semeiotic, the metaphor is related to the icon and abduction.

The ICM determines the schematic structure of a category. Knowledge about reality is, thus, organized by mental models and our experience of the external world. ICMs may provide for graded or prototypical categories and cluster categories (see section 3.2.6).

The meaning of an ICM is relative to culture. Its meaning depends on context and use within a cultural environment. The same applies for scholarly communities. ICMs, as e.g. exemplified by Temmerman (2000) and (Bryant, 2000), also exist in scientific communities, and depends on theoretical and paradigmatic commitments.

The concept of significance-effect is related to basic-level categorization, however by providing a semeiotic perspective, significance-effect is defined by the following implications:

Significance-effect: (following the definition formulated in (Thellefsen, et al., 2003))[35]

- Relates to a basic level of cognition where we organize most of our knowledge. Within a knowledge domain this is an important implication that provides for a hierarchical orientation within the concept space

- Organizes the domain knowledge.
- Express a 'force of habit', either social or natural.
- Relates to the logical interpretant.
- Possess an immense source of references (universe of discourse).
- Submit general but domain-specific information to the user (collateral experience).

Within a particular community, core concepts are considered significant because they address a particular, specified meaning and motivate a particular line of thought. Concepts have an effect because significant concepts tend to influence how objects are perceived. Furthermore, the conceptual level the significance-effect may indicate the most inclusive level of information about category members, thus following the same structure as basic level categorization.

The concept of 'banking' thus stimulates a particular line of thought which is related to finance and investment.

LIS concepts as 'documents' and 'KOS' stimulate a particular professional line of thought that includes objects and processes related to indexing of documents. We may, thus speak of indexing systems and documents at a very general level, and still be able to communicate a particular activity.

The concept of significance-effect resembles the concept of basic level effect in its ability to establish an inclusive and general level for concepts, a mid-level that establishes communicative economy. However, significance-effect re-contextualizes basic level categorization within the framework of pragmatic semeiotic. According to Lakoff, the basic level categorization is connected to the cognitive competencies of man and is relative to culture. It is a concept that is based in cognitive psychology and establishes a critique of traditional Aristotelian categorization. From the perspective of semeiotic significance-effect is an effect of meaning that relates to an object by means of an icon (similarity) and index (necessity), or a symbol (convention). The ability to decode the significance-effect of a technical term, relate to what is already known about the object. The more knowledge that is possessed by the interpreter, the more knowledge is communicated by the term.

The purpose of figure 6:1 is to illustrate the relation between concepts, the symbol representing objects and their meaning at a particular point in time. An idea (a concept) has a tendency to bring other ideas about, and consequently, contribute to the development of new concepts. A concept may, therefore, at one point in time have a particular definition, and at later point have altered or transformed into a new meaning. As shown by Temmerman (2000), there is empirical evidence that shows that categories at one point in time defined exclusively have altered their meaning and have become more fuzzy and polycentric or radially structured. This indicates that concepts and categories are formed within communities, and their meaning is determined by how they are used, for what purpose they are defined and by their underlying theoretical commitments.

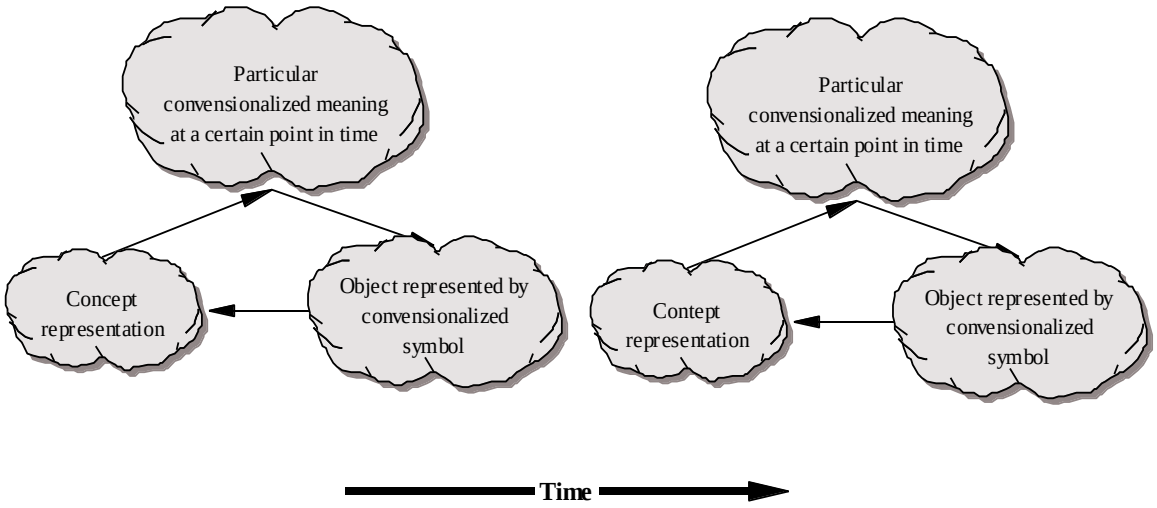


Figure 6:1: The timeline of concept representation

The sign that signifies or stands for a conventionalized meaning within a community may therefore be defined as symbols. In semeiotic terms, all conventionalized signs are symbols. Terminologies are examples of highly conventionalized symbols that names a particular concept. However, concepts may transform and develop into new meanings, but still be signified by the same linguistic symbol. Therefore, concepts include a historical dimension that influences their meaning. New meanings may be attributed by means of metaphors that blend non-related concepts and provide for new insights.

Within the field of LIS, the development of information technology has altered or added new information to the definition of key concepts. The meaning of a document has been supplemented by electronic media; the Internet has pushed forward a reconsideration of basic library services. Metaphorical buzzwords such as 'blogging' and 'social' or 'collaborative tagging' has entered the vocabulary of LIS, and is now regarded as particular kinds of Internet based and uncontrolled KOS (Macgregor & McCulloch, 2006). The point is that changes in the surrounding habitat, motivates changes in concepts.

6.3 Significance-effect and knowledge domains

The following section addresses and specifies how we may distinguish knowledge and knowledge domains as socially organized sign systems.

Generally, a distinction is made between natural science and human science (humanities and social sciences), and the kind of knowledge produced in these contexts.

In the natural sciences, knowledge is associated with truth and objectivity, and is connected with the hypothetic deductive method. Scientific knowledge within natural science is therefore related to evidence and proof provided by experiments and tests. The human sciences tend to have a more differentiated and somewhat more relative view about knowledge. Within human sciences the objects of investigation are different from the objects studied in natural science. A common statement is that the physicist studies nature, not books; the historicist studies literary sources. Within the social sciences the objects of investigation may be human social interaction and institutions within in society. These objects are made by man and are therefore influenced by culture, social processes and human conduct.

However, a knowledge domain is not necessary tied to a profession. A knowledge domain is rather tied to a specific context, i.e. a community that maintains and sanctions certain activities. Therefore, within the domain of science, research must adhere to the conventions of the domain in order to be accepted by fellow researchers. Within the domain of a private household other rules for acceptable behavior is prevalent.

Knowledge, and what count as knowledge is thus first and foremost dependent on the regularities that are sanctioned by a community.
Therefore, in order to consider what count as knowledge in a knowledge domain it is imperative to relate knowledge to:

- Communication: by what means knowledge is communicated within a community.
- Stability: how knowledge creates stabile structures of concepts and terminology that enables successful communication.
- Concepts: concepts and concept relations are important elements in a knowledge domain. Concepts create distinctions and unite and separate objects within a community.
- Terminology: how the conceptual structures of a knowledge domain may be addressed and maintained by means of highly conventionalized linguistic signs.

6.3.1 The dynamical communication model – The Dynacom

Relating knowledge to communication has some important consequences. Firstly, knowledge is an act performed by a communicator with intent and purpose.
Secondly, communication takes place by means of signs and sign systems, which may be of written, oral or schematic types.
Thirdly, knowledge in order to be communicated, must adhere to a familiar (or general) knowledge base. This knowledge base may be addressed as the collateral experience of the community.
Fourthly, in order for the communication to be meaningful, the communication must relate to a common ground or community, a universe of discourse that frames the basic theoretical assumptions of the community.
Figure 6:2 illustrates a communication model based in the triadic model, placing collateral experience and the universe of discourse as implicit parts of the interpretants.

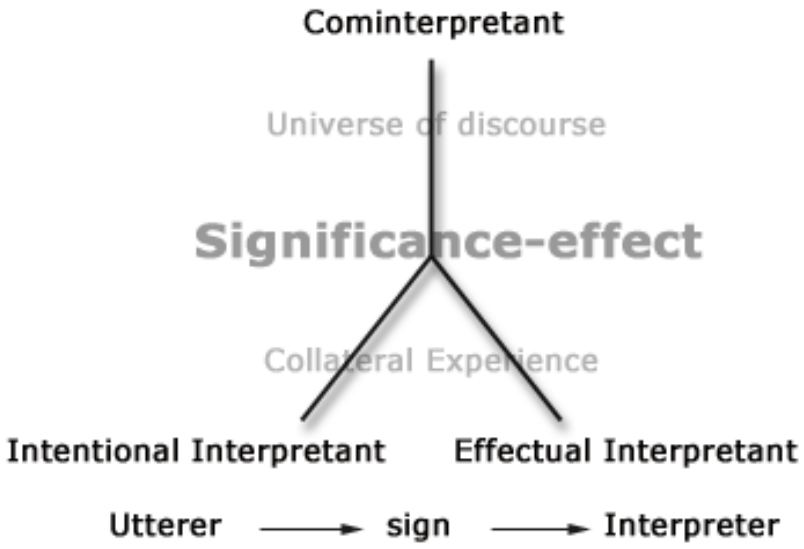


Figure 6:2: The Dynacom model. The model was published in (Thellefsen, et al., 2006)

The communication model illustrates how the significance-effect emerges as an effect caused by a meaning intentionally communicated by an utterer.

The communication model consists of a triad of interpretants; the intentional interpretant should therefore be understood as the sender of a message. The effectual interpretant represents the occurrence of a meaning effect established by the perception made by the receiver of the message. However, any communicative act may result in an interpretive effect. The correct interpretation of a message requires a conceptual community. The community is in the model represented by the universe of discourse, and the meaning of a concept is considered the cominterpretant in the semeiotic model.

The cominterpretant is also what distinguishes the model from the traditional communication transference model à la Shannon and Weaver. The cominterpretant and the concept of universe of discourse signify that within a communicative situation exemplified by two communicators addressing an object from the same viewpoint, i.e. the same scientific perspective, the cominterpretant is more likely to occur. Contrarily, if two communicators representing opposing paradigms or different fundamental values were to communicate, the cominterpretant is less likely to occur. Furthermore, the sender of a message need not be a person, it could be an information system, e.g. a

particular KOS, or it could be a commercial brand, e.g. institutions communicate with intent as well as a person.

The significance-effect is therefore defined as an effect of meaning. As such, the significance-effect is the result of a communicative process that requires the presence of collateral experience that unites an utterer and a receiver with a common ground or background knowledge. Of course, it is also an idealistic model, and significance-effect should be regarded as scalable.

> *"In one sense […] a community requires that its members be capable of coming into an immediate or mediate intellectual relation; in other words, the first formal condition of having a community is that its members are capable of mediative or sign-interpreting capacity to some degree. Second, there must be some connection or relation, especially a communicative one, between such sign users. Third, […] this connection or relation must be established as "ours" in some sense, that is, there must be some identification with this relation on the part of those so related. The first condition allows the possibility of the second, since signs enable us to transform objects or events into meanings, which in turn allow the possibility of something being shared and shared in a communicative fashion. The second condition allows for the possibility of the third, since identifying shared meanings as "ours" assumes that there is, first of all, something that can be shared." (Liszka, 1996, p. 83)*

As discussed above, knowledge is fallible. History shows us that what at a particular point in time was regarded certain knowledge, may be altered by new discoveries, therefore, no knowledge is absolute and certain. However, collateral experience may provide for provisionary stabile knowledge claims. If a community shares collateral experience about specific objects, it may choose to address these objects by conventionalized concepts and terminology that offer a more efficient communication. The Dynacom model and its constituting parts will we discussed further in the next chapter.

6.4 Summary

Lakoff and Peirce formulate quite different approaches to concepts and categorization. Based in experientialism and embodiment, Lakoff argues that knowledge and categorization are based in human perception, and argues against objectivist theories that claim absolute truth, and correspondence between external reality and perceived reality. Even though Lakoff dismisses Cartesian dualism, it seems like a dualism is reproduced by Lakoff's definition of experiential realism because it basically agrees with basic realism, that acknowledges the existence of a real world external to human beings, a commitment to the existence of stabile knowledge about the external world, and a rejection of the view that any conceptual system is as good as any other. But, on the other hand, Lakoff claims that our conception of the world is based in experience, language and bodily motor movements. Categorization is thus a product of human mind. Consequently our knowledge about the external world is obscured by our cognitive abilities.

In summary, Lakoff thus reproduces a distinction between a mind independent external world and knowledge about the external world.

Peirce acknowledges the existence of an external world however, he explains the relation between human mind and nature by means of structural affinity. We may thus acquire a relative stabile knowledge about the external world because nature and human mind belongs to the same continuum.

The concept of significance-effect is proposed, and is developed from the analysis of Lakoff's and Peirce's respectively different approaches to concepts. Basically, significance-effect is considered a synthesis between basic level categorization and Thirdness. Significance-effect thus considered implicates that concepts may be organized according to a basic level however, significance-effect is also an effect of meaning that is relative to the interpreter. Significance-effect is therefore dynamical, and determined as interplay between collateral experience and a universe of discourse.

In chapter 5, the concept of sign-displacement was introduced based on the elaborate divisions of the interpretant. Table 7 demonstrates three analytical levels of the intepretant with regard to signification, cognition and communication. The Dynacom was developed based in the triad of communication, thus, involving an intentional

interpretant - a communicator with intent, an effectual interpretant - an addressee of the message, and the cominterpretant - the level that unites the sender and receiver of a message in mutual understanding. The Dynacom incorporates the idea of significance-effect that, thus, stands for an effect of meaning, mutually understood in the communication process. The value of the Dynacom is that it is a dynamical communication model that deliberately functions at the level of the interpretant. It does not presuppose a human communicator. The intentional interpretant may be communicated by an information system, and it summarizes the idea of social knowledge (the cominterpretant), e.g. a paradigm, and the interpreters state of knowledge. This means that the significance-effect is graded, and dependents on shared experience. It is thus implied that a sign communicates a meaning about state of affairs within a community, but the effectual interpretant depends on how much the interpreter already knows about the sign. Consequently, KOS communicates by means of different types of subject representations, but, where the KOS's are relatively stabile, the effect produced in a perceiving mind may vary significantly based on the perceiving minds expertise and state of knowledge.

7 Discussion: How does the Dynacom contribute to our understanding of KO and KOS?

Introduction

As demonstrated in chapter 2, KOS's are considered semantic systems that express semantic relations of different granularity. It was argued that the ontology was the most developed kind that in principle is capable of incorporating the full spectrum of semantic relations demonstrated by other KOS's. It was also argued that KOS's generally are tools that exercise authority control over semantic units, and thus favor strong (formal) models of representation based in objectivist semantics. Thus, in the organization of knowledge, priority has in particular been given to theories and methods that have a particular focus on the processes and semantic structures within systems, more than theories and methods focusing on the process of interpretation and, thus, pragmatic meaning.

Extending the discussion of semantics into concept theory, it was demonstrated that the distinctions between the three philosophical schools of concept theory, as formulated by (Ereshefsky, 2001): Essentialism, cluster analysis and the historical approach, provided for a useful theoretical framework for addressing the nature of different kinds of KOS. Essentialism assumes concepts to be objective, universal and enduring, and thus based in rationalist or empiricist epistemology. Cluster analysis assumes concepts to be graded, prototypical and context sensitive, and thus dismisses the essentialist idea of objective concepts and categories. Cluster analysis was thus related to socio-cognitive and culture relative epistemologies. The historical approach gives priority to methods unravelling the meaning of concepts by means of historical investigations, in order to determine how they are developed and related to theories and paradigms; and, furthermore, how concepts are used in communication in a social environment. The historical approach was also related to theories favoring an interpretive framework, as e.g. discourse analysis, critical theory, pragmatic pluralism and genealogy. It was

argued that the semeiotic approach developed in chapter 4-6 is in line with the historical approach.

In chapter 6 a synthesis between cognitive semantics and semeiotic was developed, and concluded in the concept of significance-effect, which is an effect of meaning that depends on conceptual alignment between an utterer and an interpreter.

This chapter is focused on the last part of the research question: 'Can semeiotic and cognitive semantic theory offer a more elaborate understanding of concepts, and how concepts are organized and represented?'

Based in the semeiotic analysis summarized in the Dynacom, six principles are identified as important in relation to KOS development.

7.1 What may be learned from the semeiotic analysis and how may semeiotic theory influence the conception and development of KOS?

Basically, the semeiotic analysis tells us that signs are motivated by an object. An object is an exterior to a mind, however, an object may be perceived in a certain manner and be meaningful to a mind only by means of interpretation. The interpretation of an object produced by a mind thus generates an immediate object that corresponds to the interpretative habit performed by the mind. This habit of interpretation is the function of the interpretant. The interpretant level of the sign vehicle thus connects the sign with an object.

Concepts are considered logical interpretants of an immediate object in the sign chain. The logical interpretant is defined as the meaning of an intellectual concept. The meaning of intellectual concepts, however, is determined by a common ground which is the context of the sign relation.

> *Thus the essential office of the copula is to express a relation of a general term or terms to the universe. The universe [of discourse] must be well known and mutually known to be known and agreed to exist, in some sense, between speaker and hearer, between the mind as appealing to its*

> *own further consideration and the mind as so appealed to, or there can be no communication, or "common ground," at all. (CP 3.621)*

Therefore, concepts must be generals that, in order to be communicable, must be determined by something else than a subjective mind. The meaning of intellectual concepts, thus, relates to general ideas that are shared by a speaker and a hearer within a universe of discourse. The following subsections express six principles that, based in the semeiotic analysis and the Dynacom, are considered important in relation to KOS development.

7.1.1 Determining the domain (the universe of discourse)

Fundamentally, a KOS is a systematic conceptual system which is designed with one purpose, namely, to provide feasible representations of subject data that support the process of information retrieval. As a consequence, a KOS is a system of representation that stands for something else. However, what is the character of this 'something else'? What is the object? Does a KOS represent a terminology? Concepts or categories? Or simply a particular professional way of thinking in terms and categories? Based on the discussions of KOS in chapter 2, I consider the last question to be the right one. A KOS may use terminology to represent concepts and categories; however, the structure of a KOS is deeply rooted in the professional praxis and functionality of libraries. As a consequence, a KOS may be more or less distanced from the disciplines it represents.

This may be a trivial point, and many library users have learned to live with the peculiarities of KOS's. However, a less trivial point is that the organization principles conducted by a particular KOS demonstrate a way of thinking that may be inadequate or, at worst, misleading for users, simply because the principles of semantic structures dominate at the expense of pragmatic approaches. The point is that if concept theory is more actively reflected by KOS designers, it may have a positive effect on the quality of KOS. This point is, however, difficult to demonstrate empirically.

As demonstrated by Hodge (2000), different types of KOS can be identified and arranged according to semantic complexity and formal expressiveness. KOS's are thus organized according to three main types: Term lists, classification and categories, and

relationship lists. These may of course be divided even further, as described in section 2.1.1.

The KOS design should meet the knowledge of a community regardless of whether it is a scientific discipline, a public institution or a commercial enterprise, which means that concepts should be determined pragmatically. In particular Hjørland have advocated in favor of a pragmatic approach that includes the scholarly, socio-cognitive, discourse specific and paradigmatic dimensions of KOS (Hjørland, 2007b). Concepts and concept relations should be determined according to how they are understood, used and communicated within a community. This perspective is sensitive to the social organization of knowledge, which is in line with domain analysis and socio-cognitive terminology and the semeiotic approach promoted here. Furthermore, many concepts are fuzzy, and knowledge about objects that fall under a particular concept may be incomplete, which means that concepts in many cases are organized according to prototypes. As demonstrated by Temmerman (2000), concepts that at one point in time have been defined clear cut can gradually become fuzzy as a consequence of research developments within a community.

The meaning of a concept is, thus, determined by a universe of discourse. A universe of discourse can be as loosely defined as a language game, or more strictly determined as a set of logical premises. What is important is that the universe of discourse must be shared, as a common stock of knowledge, in order for correct interpretation to be possible.

> *In every proposition the circumstances of its enunciation show that it [the universe of discourse] refers to some collection of individuals or of possibilities, which cannot be adequately described, but can only be indicated as something familiar to both speaker and auditor. At one time it may be the physical universe, at another it may be the imaginary "world" of some play or novel, at another a range of possibilities (CP 2.536).*

Furthermore,

> *The point is that a Universe of Discourse is connected to a common field of interests and purposes and that objects are identified and developed only in relation to that common field. (Joswick, 1996, p. 99)*

Accordingly, a universe of discourse could be exemplified as one way of navigating through KOS representations, e.g. recognizing the meaning of (NT, RT, BT) in a thesaurus, or navigating and understanding the structure of a classification system or an ontology.

7.1.2 Determining the social organization of communities (collateral experience)

Being sensitive to the social organization of the particular community is important, because the meaning of concepts is anchored within a social context. Consequently, within scholarly communities, paradigms are essential because paradigms provide for the general perspective that support theories and methods and, thus, have major impact on how concepts are understood.

Collateral experience is closely related to a universe of discourse. Collateral experience exists within a universe of discourse, but where the universe of discourse determines the possible organization of objects, collateral experience is the actual knowledge about concepts shared by speakers and hearers within a community. Peirce explains:

> *... I point my finger to what I mean, but I can't make my companion know what I mean, if he can't see it, or if seeing it, it does not, to his mind, separate itself from the surrounding objects in the field of vision. It is useless to attempt to discuss the genuineness and possession of a personality beneath the histrionic presentation of Theodore Roosevelt with a person who recently has come from Mars and never heard of Theodore before (CP 8.314, 1909).*

Collateral experience is, thus, the stockpile of knowledge acquired through interpretations of various dynamical objects. According to Pharies (1985), collateral experience also includes purely contextual information.

> *If my companion calls 'beautiful' a person I know to be undeniably ugly, I may infer, on the basis of this collateral knowledge (and perhaps, on the basis of knowledge of my friend's personality, past utterances, relation to the person spoken of, the nature of the conversational situation, the presence or absence of the person spoken of, etc. – in sum, the entire universe of discourse), that my friend is speaking ironically (Pharies, 1985, p. 19)*

The quotation of Pharies demonstrate that a communication process always includes a complex of past and present experiences.

In relation to a scholarly domain, the collateral experience would include the knowledge acquired through reading books, attending seminars, through exercises, how to perform certain activities, etc., all aspects that simultaneously are at play when communicating about an academic problem. In summary, collateral experience consists as a complex network of different kinds of knowledge, e.g. embodied knowledge, practical knowledge, iconic, indexical and symbolic knowledge, situational, propositional and argumentative knowledge, etc.

The Dynacom, see fig. 6:2, demonstrates how the universe of discourse and collateral experience takes part in the communication process as implicit or sub-cognitive elements of the interpretation.

7.1.3 Determining the principle of communicative alignment - the cominterpretant

> *There is the Intentional Interpretant, which is a determination of the mind of the utterer; the Effectual Interpretant, which is a determination of the mind of the interpreter; and the Communicational Interpretant, or say the Cominterpretant, which is a determination of that mind into which the minds of utterer and interpreter have to be fused in order that any communication should take place. This mind may be called the commens. It consists of all that is, and must be, well understood between utterer and interpreter, at the outset, in order that the sign in question should fulfill its function. (EP 2:478, 1906)*

The success of communication presupposes the occurrence of a cominterpretant. The cominterpretant occurs if the speaker and hearer share a similar understanding of a universe of discourse, and also share similar ideas about what is communicated, the latter being collateral experience. If the intentional and effectual interpretant can be made identical, e.g. by means of dialogue, *"the cominterpretant occurs as the identity between the interpretation of the parties engaged in a dialogue"* (Dines Johansen & Larsen, 2002, p. 210).

Consequently, the cominterperetant thus constitutes a state of shared understanding, or communicative alignment.

7.1.4 Determining the principle of pragmatic pluralism

Terms are symbols, and are names for concepts. A term is a rhem, a concept is a unit of meaning. A concept is motivated by an object, and the meaning of an intellectual concept is conveyed by the logical interpretant.

The object, 'that to which a sign refers', is divided into the immediate object and the dynamical object. The immediate object is a mind's understanding of the dynamical object. The dynamical object motivates the signification process; however, the reality of the dynamical object is independent of the sign. The logical interpretant is considered the meaning of an intellectual concept, but the logical interpretant is not considered an ultimate or final interpretant, and therefore the logical interpretant represents an immediate object.

The terminology provided by a KOS represents concepts of a community; however, the relation between the concepts represented by the KOS and the 'live' concepts used within a community is similar to the difference between the immediate object and the dynamical object. A KOS representation is motivated by, and is a replica of, the dynamical object. However, by being an immediate object, it is biased by perspective and interests different from the community it represents.

A KOS establishes a semantic structure of subject representations (logical interpretants); however, a KOS should be considered a quasi-mind, and, thus, the end of other minds' speculation. The terminology of a KOS thus suggests a particular meaning and organization of concepts that is rooted in the theories and methodologies of KO.

Therefore, it is important to incorporate theories and methods that are sensitive to the dynamics of a social environment, the dynamics of concepts, and the theories and/or paradigms that determine which theories are applied and how concepts are understood.

The concept of pragmatic pluralism is discussed by (Rosentahl, 1994), and is developed as a principle that emanates from Peirce realism and pragmatism. Skagestad (1981), uses the term 'pragmatic realism' about what Rosentahl names pragmatic pluralism. Both suggest that an object may be ascribed different meanings depending on perspective. Consequently, based on the principle of pragmatic pluralism, correspondence between a representamen and an object is determined by a universe of discourse. Thus, different views (paradigms, scientific disciplines, practices) may produce different, equally valid interpretants based on the same object of investigation. As a consequence, the meaning of concepts is relative to research interests.

7.1.5 Determining the principle of significance-effect

Significance-effect is considered an effect of meaning. It is the result of a communication process that takes place within a universe of discourse, and it requires collateral experience. Thus, significance-effect is considered an effect of meaning determined by a universe of discourse communicated between an utterer and an interpreter.

The significance-effect is, furthermore, considered an effect in the same sense as stimuli provoke a response. As a consequence, significance-effect is not by itself the whole meaning of a concept communicated by a speaker. Significance-effect is rather an effect of meaning that manifests itself as a consequence of the effectual interpretant determined by an interpreter. Different interpreters may, thus, in principle inhabit different significance-effects.

This definition of significance-effect is different from the definition elaborated by T. Thellefsen (Thellefsen, 2009), which distinguishes between two types of significance-effect, a normative significance-effect, which is considered the normative meaning of a concept, and a sub-cognitive significance-effect, which is considered an emotional effect of meaning.

The definition provided here does not distinguish between the two types of significance-effect, but is considered a further elaboration of the definitions provided in (Thellefsen, et al., 2003; Thellefsen, et al., 2006). Here, significance-effect is determined as a relative effect of meaning, where the knowledge communicated by a concept is considered relative to the knowledge possessed by the interpreter. However, the definition used in this context, where significance-effect is considered relative to a universe of discourse and collateral experience, may correspond to the sub-cognitive significance effect as suggested in T. Thellefsen (2009). Future investigations are needed in order to clarify this aspect.

7.1.6 Determining the principle of sign-displacement

Fundamentally, a sign displacement adheres to the immediate object. An immediate object is defined as a mind's own representation of the dynamical object, and is, thus, displaced from the dynamical object. The displacement thus relates to the difference of perception of the dynamical object.

From the perspective of a community, sign-displacement exists because concepts produced within a community are based in theoretical assumptions about the reality they are meant to represent. Consequently, concepts are provisionary, and may be continuously revised by future investigations.

According to Peirce, the progress of science is determined by the dynamical object which is actual reality. The immediate object constitutes our interpretations of the dynamical object at some interim stage of inquiry. Accordingly, science may progress towards greater certainty.

7.1.7 Revisiting the Dynacom

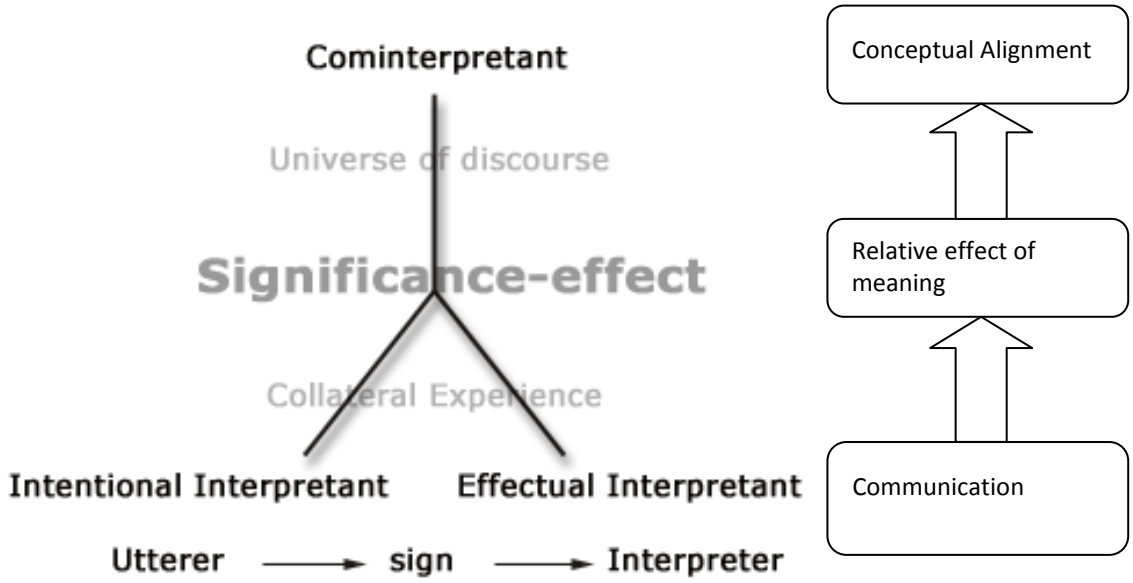


Figure 7:1: The Dynacom revisited, including the levels of understanding

Figure 7:1 demonstrates the Dynacom in relation to levels of understanding. At the lower level of communication, any utterance from a speaker may have an effect on a hearer, but this is not the same as to say that the communication process was successful, or that an exchange of shared meaning took place. The relation between the intentional interpretant and the effectual interpretant thus constitutes the lowest level of communicative interaction, and may be understood as mere transmission of utterances between a speaker and a hearer.

The mid-level, determined by the significance- effect, is considered an effect of meaning, however, as indicated by the three levels of understanding, significance-effect is considered a relative effect of meaning. At this communicative level, the speaker and hearer may not share similar understandings of the concepts communicated, but the hearer must at least possess an idea about the concepts communicated. An example could be a professor communicating to his students, where there exists an asymmetry between the knowledge of the speaker and the knowledge of the hearer.

At the most developed level of communication, the cominterpretant occurs. The communication between a speaker and a hearer is here considered symmetrical. An example would be two professors within the same domain participating in a debate. Conceptual alignment, thus, refers to a shared understanding of concepts, but not necessarily agreement of the academic value of concepts.

Economists may agree that we are in the middle of a financial crisis; however, they may disagree in terms of how to intervene in order to secure the economical development of the future.

The Dynacom is, thus, a dynamical model that determines the formal conditions for communication that includes different levels of understanding, and incorporates the possibility of disagreement at the level of the cominterpretant.

7.2 Exemplification: In this section, the six principles of the Dynacom model will be exemplified based on a case study in Occupational therapy.

7.2.1 Understanding the universe of discourse (OT)

Occupational therapy is, from the perspective of the American Occupational Therapy (AOTA), defined as *"…a science-driven, evidence-based profession that enables people of all ages to live life to its fullest by helping them promote health and prevent - or live better with - illness, injury or disability". (www.aota.org)*[1]

According to Cole & Tufano (2008), eight major trends may be identified within the profession of occupational therapy (OT).

The first trend regards how occupation of humans is perceived, consequently, moving away from the medical model; patients are perceived as clients that make informed choices about treatment, instead of being passive recipients of treatment. The second trend follows from the first, and is characterized as a holistic approach. The

[1] http://www.aota.org/Consumers/WhatisOT.aspx

reductionism of the medical approach, which is based in a mechanistic paradigm, is considered inadequate when dealing with the complex, interdependent unity of physical, psychological, social and spiritual aspects of human life. The third trend concerns the definition of occupation. According to Christiansen (Christiansen, 1999, p. 547), "…*the ultimate goal of occupational therapy services is well-being not health*". Consequently, the view of occupation expands into all aspects of life (Cole & Tufano, 2008). The fourth trend identified relates to the understanding of cognition, sensation and neuroscience. Research in these areas provides for more specific strategies for intervention. The fifth trend in OT is that occupational science, all though related, is considered a separate academic discipline apart from occupational therapy. Occupational science is not merely a frame of reference or a model of practice, but the scientific study of occupation (Wilcock, 2008). The sixth trend is the establishment of an evidence based practice. Evidence refers to research studies showing the effectiveness of OT techniques. Occupational therapists need to justify and provide evidence to clients as well as to the community (Holm, 2000). The seventh trend relates to the human adaptation in the context of culture and community. The eighth trend is putting the client first, thus establishing a client-centered practice. This marks a clear departure from the medical model, and establishes a focus on the subjectivity of occupation from the client's perspective.

Apart from these trends, OT is also characterized by its historical development, which can be divided into three main periods that exemplify different stages of scientific development. The contour of this development reviewed below is based on (Borg, Runge, & Tjørnov, 2003; Burke, 1984; Cole & Tufano, 2008; Kielhofner, 1997; Kielhofner & Burke, 1977).

The first period is labelled 'the classical paradigm', or 'the paradigm of occupation'. The second period is named 'the mechanistic paradigm' and the third period, 'the dynamical systems view', or simply, 'a new emerging paradigm' (Cole & Tufano, 2008; Kielhofner, 1997).

The early paradigm (1900-1940), 'the (classical) paradigm of occupation', was focused on occupation and its role in human life and in health. Occupation was mainly

considered in its restorative function of lost abilities. The early paradigm thus emphasized a holistic viewpoint, seeing mind and body as a whole.

The mechanistic paradigm aligned with the medical model of OT developed in the 1950s, and was based on scientific rationality or scientism. The focus is shifted from the mind, body, environmental holism – towards neurological, anatomical and intrapsychic dynamics.

The mechanistic paradigm provides for a change in practice. Holistic thinking is replaced by reductionism with emphasis on the internal workings of the human psyche and body. However, the narrow focus of the mechanistic paradigm fails to address problems that extend the pure mechanics of internal mechanisms, as e.g. what it means to function as an individual in a social environment, a society, or to strive for a meaningful life etc. These aspects of life are complex and non-reducible, and, therefore, outside the scope of the mechanistic paradigm.

From the 1980s to the present, 'the systems view', also referred to as 'the dynamic systems view', has emerged as a new strong paradigm that is better equipped to approach the complex nature of daily living. From this viewpoint, the mechanistic paradigm, with its particular focus on understanding the architecture underlying occupational behaviour, is challenged by 'the systems view' that replaces architecture with process.

> *The emergent paradigm [the systems view] reflects the fact that practice is biopsychosocial. This means that therapists encounter a wide range of phenomena for which they require understanding and guidelines for action. The diversity of these many phenomena compels the field towards more than a single theoretical and practical system. (Kielhofner, 1997, p. 95)*

This short presentation exemplifies how a historical approach is helpful in determining the character of OT. OT is thus described as an interdisciplinary scientific domain that has developed through the stages of three dominant paradigms, where the latter is still in development.

At a general level, this historical summary establishes a basic knowledge about the universe of discourse of OT, which is considered valuable for understanding how concepts, theories and methods are connected. Of course, further studies into the specifics of the different paradigms would be a valuable source of information that would qualify the development of a KOS.
Further studies into the basic literature of OT would be valuable in order to determine different practices and schools of OT.

7.2.2 Understanding the social organization of the community (Collateral experience)

Collateral experience determines what must be known about a universe of discourse in order for communication to be meaningful. Also, collateral experience includes contextual information, thus, delimiting the possible meaning of expressions or concepts. This means that knowledge about communicative structures is important. This could include how and where valuable information sources are located, what sources of information are important, which channels communicate the latest knowledge and research of the field etc. Furthermore, collateral experience includes knowledge about the terminology of the field, about concepts, and how they attach to theories and methods, and, in the case of OT, practices of intervention in relation to clients. Collateral experience may also include knowledge about important institutions, about health care, about procedures and techniques experienced through practice etc.
The universe of discourse and collateral experience thus constitute a level of experience that is present at a sub-cognitive level. Studies and enquiries into the collateral experience, e.g. in terms of tacit knowledge, may be valuable for determining concepts and concept relations in a KOS.

7.2.3 Understanding the principle of communicative alignment

As stated in 7.1.3, communicative alignment – or the cominterpretant – occurs in a communication situation when a speaker and hearer share a similar understanding of concepts. Communicative alignment is thus a measure of agreement of the meaning, context and use of concepts; however, communicative alignment is not the same as

consensus. In a communication situation, a speaker and a hearer may be in agreement about how particular concepts are understood, but simultaneously disagree about the commitments and consequences determined by particular concepts.

In 7.2.1, the short historical summary of OT, it was stated that OT has developed through different stages of paradigms. Different paradigms favor different methods, and, thus, different understandings of how to approach human occupation. Consequently, individuals who subscribe to the dynamical systems' view may perfectly well understand the concepts and methods developed under the mechanistic paradigm, but still disagree. Communicative alignment is, thus defined, a shared understanding, which of course is a precondition for conducting a purposeful professional debate.

7.2.4 Understanding the principle of pragmatic pluralism

Pragmatic pluralism is an important concept, because it suggests that concepts may be related to different models of understanding and have different meanings dependent on context, perspective and use. OT, being an interdisciplinary research field, may thus import concepts, theories and methods from other research fields and redefine them according to the prevalent theories, methods and practice of OT.

According to Kielhofner (Kielhofner, 1997, p. 106), there may within 'the dynamical systems view' paradigm be identified eight different models of therapeutic intervention. The models are:

- The biomechanical model
- The cognitive disability model
- The cognitive-perceptual model
- The group work model
- The model of human occupation
- The motor control model
- The sensory integration model
- The spatiotemporal adaptation model

These models all form distinct universes of discourse, and provide for different foci and methods of therapeutic practice.

7.2.5 Understanding principle of significance-effect

As stated in section 7.1.5, significance-effect is an effect of meaning that depends on knowledge acquired by collateral experience within a universe of discourse. Consequently, significance-effect is relative to what is already known about an object.

We may thus assume it to be likely that Kielhofner's eight models of intervention, mentioned previously, provide more sensible information to a professor of OT, than to a student of OT. Furthermore, we may also assume it to be likely that a KOS designer knows even less about the models. The significance-effect may, thus, be graded from the lowest level of acquaintance to the level of professional analytical insight. A concept thus communicates information relative to the knowledge state of the interpreter.

A KOS should be designed with this diversity of knowledge states in mind.

7.2.6 Understanding principle of sign displacement

The concept of sign displacement was developed in chapter 5, and is related to a particular understanding of a phenomenon at a certain point in time and of the phenomenon itself. Sign displacement is, thus, a condition of perception and reasoning. By means of theories and empirical investigations, it is possible to acquire knowledge about phenomena in the world; however, absolute knowledge about phenomena is beyond our grasp.

Consequently, agreement about concepts at the level of the cominterpretant suggests that we may only agree to a certain extent about particular understandings about certain phenomena.

The historical development of OT went through three paradigms, which suggests that the demand for providing treatment for clients has required theoretical and practical developments.

The paradigm called 'the dynamical systems view' thus incorporates aspects of the previous dominant paradigms, however, with a different theoretical approach. This

'new' approach may provide for better treatment of clients, but may also eventually evolve into a new paradigm in the future. At least that would be in line with the semeiotic and pragmatic logic of Peirce.

Sign displacement thus expresses a particular understanding of the nature of knowledge, as a state of provision, that never will be absolute or complete, but rather continuously develops towards greater certainty.

7.3 Summary

In this section I have elaborated on the constituent parts of the Dynacom. The Dynacom constitutes a dynamical communication model that is developed based on Peirce's pragmatic semeiotic. The Dynacom functions at the level of the interpretant in a sign process, and expresses the fundamental conditions of communication. The Significance-effect is an important outcome of the communication process, and is considered an effect of meaning relative to what is already known by an interpreter. The significance-effect thus presupposes the sub-cognitive levels of a universe of discourse that frame the communication within a context and collateral experience, and that relates to the knowledge and acquaintance with the universe of discourse. Where the universe of discourse determines the possibilities of knowledge, collateral experience is the actual knowledge of concepts shared within a community.

Being a dynamical model of communication, and thus related to a provisionary determination of concepts, the Dynacom transcends the idea of true correspondence between a representation and an object. Also, the model implicates that concepts always are negotiated by speakers and hearers.

The principles were exemplified further by a minor case study. The function of this study was to provide for context information regarding the six principles discussed. The study does by no means claim to be exhaustive, but only indicative. Further research is needed in order to investigate the usefulness of the Dynacom model in KOS development.

8 Conclusion

In this dissertation I have enquired into the relationship between different forms of KOS's and their communicative functions. The investigation has been carried out by, firstly, demonstrating that KOS's are semantic systems that function at different levels of granularity, and that KOS's are systems of representation that depend on reasoning and language. Furthermore, I have demonstrated that traditional KOS's are prescriptive and related to strong models of representation, thus, favoring rational models of representation. It was furthermore argued that KOS's, at different levels of granularity, include several types of semantic relations, mainly based in a syntactical, structural understanding of concepts. However, it was also demonstrated that other kinds of semantic relations based in a pragmatic and discursive understanding of concepts was needed. The semeiotic approach was here argued, to offer a theoretically and practically oriented view that embraces a wide perspective on concepts, knowledge and communication. The semeiotic theory approaches the meaning of concepts from three levels of understanding (see table 3): the level of signification, the level of cognition and the level of communication. In particular, the level of communication is of interest because it implicates the other levels, and suggests that concepts are determined by use in a context.

Secondly, I have analyzed KOS's in relation to concept theory and demonstrated that KOS's can be characterized by being related to different theories of concepts. The theoretical distinction between different approaches to concept theory was based on (Ereshefsky, 2001), where concept theory was divided into three main philosophical categories: essentialism, cluster analysis and the historical approach. Cluster analysis was given particular attention, because it includes a graded socio-cognitive approach to concept theory. It was argued that cognitive semantics as formulated by Lakoff (1987) and Lakoff & Johnson (1999), is related to cluster analysis, and the cognitive schemes as basic level categorization, metaphor and ICM constitute important principles of

conceptual structure. Also, the cognitive schemes were later related to the interpretant in the semeiotic approach.

The aim was here to demonstrate that concepts are anchored in a non-reducible complex of socio-linguistic and pragmatic context. And also that awareness of this founding may contribute to KOS development. Furthermore, the concept of pragmatic pluralism was introduced, and related to the historical approach. Pragmatic pluralism, as argued by (Rosentahl, 1994), is developed from Peirce's distinction between metaphysical possibility and epistemological actuality, the latter being the realm of concepts that is based on perceptual knowledge. Rosentahl also connects pragmatic pluralism to Kuhn's theory of paradigms, and thus adds to an understanding of Kuhn that considers successive paradigms as continuous developments. Even though paradigms are considered incommensurable, a new paradigm must be motivated by the inadequacies of previous paradigms. Rosentahl's exposition of pragmatic pluralism suggests that concepts are determined by perspective. A given object may thus be understood differently, based in different knowledge interests. Therefore, concepts are never absolutely determined, but based on the consecutively developing knowledge interests of e.g. scientific communities.

The discussion of KOS and concept theory summarizes the different kinds of KOS under the terms 'essentialism', 'cluster analysis' and 'the historical approach'.

Having thus established a relation between KOS's and concept theory, Peirce's semeiotic is promoted as a theoretical framework that embraces the complex relation between representation, represented and interpretation, and one which matches the complex nature of concepts. The distinction between immediate object and dynamical object is introduced, expressing the provisionary relationship that exists between a representation and its object. This insight is important, because a concept will always establish immediate understandings of objects, and be subject to change, motivated by future investigations.

Consequently, if concepts are themselves dynamical, based in provisionary knowledge, KOS's are also subjected to dynamical development. As a result, KOS's demand continuous maintenance.

Thirdly, based on Peirce's late semeiotic, the concept of sign displacement is developed. Sign-displacement is determined as a semantic distance between the immediate object, which is defined as the provisionary knowledge established by a particular theoretical and methodological outset, and the dynamical object, which escapes absolute understanding.

Sign displacement may be considered in two dimensions: 1) One that relates to the status of scientific concepts, and, 2) one that relates to KOS representations of scientific concepts. The first type of displacement thus relates to the process of investigation that continuously sharpens or alters the understanding of concepts. The latter relates to how concepts are represented in systems, as e.g. KOS's that are more distanced from the research process, and thus may provide for more general or loosely defined concept representations. Both dimensions are important to realize in KOS development.

It is consequently argued that, in order to reduce the semantic distance between KOS concept representations and the concepts used and defined by research and practice within communities, domain knowledge is imperative.

Besides expressing a distance between an immediate object and a dynamical object, sign-displacement also relates to the interpretant. Three analytical levels of the interpretant were formulated (see table 7), which relate to signification, cognition and communication. At the level of communication, the fundamental chance for successful communication between an utterer and an interpreter is determined. As such, an utterer communicates intentionally, with an effect on an interpreter, and the communicative interpretant represent the stage where the meaning uttered and the perception interpreted are identical. Sign-displacement is thus a measure of conceptual divergence between an utterer and an interpreter in a communication process.

Fourthly, based in the elaboration of sign-displacement the dynamical communication model, 'the Dynacom', is developed. The Dynacom is based in the communicative level of the interpretant, however, as discussed, the cominterpretant occurs when an utterer and an interpreter share identical ideas about the concepts communicated. The possibility for the cominterpretant to uccor, thus implicates that something must be shared between the utterer and the interpreter. E.g., there must be a shared system of

communication, there must be a shared idea of context and knowledge, or else the cominterpretant would be unlikely to occur.

The Dynacom is based on six principles, that summarize the theoretical discussions of the dissertation: 1) The universe of discourse, which frames the context of communication, 2) collateral experience, which states what must be known by the utterer and interpreter within the communication process, 3) communicative alignment, which represents a state of shared understanding of the concepts communicated, 4) pragmatic pluralism, the notion that the meaning of a concept is determined in relation to a universe of discourse, 5) significance-effect, a sub-cognitive effect of meaning that is determined by a universe of discourse and collateral experience and 6) sign-displacement - that any representation determines an immediate object of a dynamical object.

Figure 7.1 demonstrates the Dynacom related to different levels of understanding. At the most simple level, a communication between an utterer and an interpreter always has an effect. In a communication process you may be able to recognize the words and sentences, and even be able to recognize the communication as argumentative series of statements; however, you may perhaps not share a similar understanding of what is communicated. At the mid-level, the level of significance-effect, a relative effect of understanding is determined. We may speak of asymmetrical communication between an expert and a novice. The most developed level of communication is when the cominterpretant occurs, which is explained as conceptual alignment. Conceptual alignment presupposes symmetrical communication, e.g. two experts communicating about a problem within their field of expertise. An important point is that conceptual alignment does not presuppose agreement, only that the utterer and interpreter share the same understanding of the concepts communicated.

The Dynacom thus constitutes the formal condition for communication between an utterer and an interpreter, and is related to the levels of understanding. I have, thus, demonstrated the scope of representation by different kinds of KOS's, related KOS's to concept theory, and, by means of semeiotic analysis, enquired into the nature of concepts and communication. I have, thus, also demonstrated that the semeiotic approach provides for a deeper analytical perspective on representation and

interpretation of concepts. Also, by means of a minor case study in occupational therapy, I have demonstrated that the theoretical framework provided by semeiotic analysis suggests the six elements included by the Dynacom as fundamental elements in a communication process. The function of the case study is, however, tentative, and further research is needed in order to develop a more elaborated model of concept analysis useful for KOS development.

8.1 The value of the dissertation

The value of the dissertation is that it adds to the continuous theoretical reflection and development of KO. The dissertation, by means of semeiotic, adds to an interpretive framework of concept theory and based in this framework, develops a model of investigation that determines the fundamental levels of conceptual meaning based in communication.

The dissertation contributes to the work conducted in (Thellefsen, et al., 2003) and (Thellefsen, et al., 2006), and thus takes the first tentative steps towards a semeiotic of knowledge organization that incorporate semantic theory, in terms cognitive semantics and paradigm theory, in terms of pragmatic pluralism.

Further research based in the model is, however, needed in order to demonstrate the full value of the model in KOS development.

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Notes

[1] Knowledge organization (KO): Within the library and information science (LIS) community, KO is particularly concerned with organization theories and -methods related to information sources and bibliographical systems. Knowledge organization systems (KOS) encompass all types of schemes for organizing information sources. KOS's include classification schemes, subject headings, authority files but also semantic networks and ontologies. The purpose of KOS's are retrieval and management of a collection of information sources (G. Hodge, 2000).

[2] I use the term 'information sources' for two reasons: 1. It represents an inclusive concept, and it embraces any object that motivates an interpretive act, and 2) by using the term 'information sources' instead of 'document' the LIS debate of what constitutes a document is circumvented.

[3] Information seeking and IR are both concerned with information behavior activities, but from different perspectives. Information seeking is concerned with a user's or group(s) of users' purposive seeking of information, in order to satisfy an underlying goal (Wilson, 2000). IR is concerned with the processes involved in representation, storage, searching, finding, filtering and presentation of information (Ingwersen & Järvelin, 2005).

[4] Library and Information science (LIS) is a scientific field that includes different, more or less connected, disciplines. KO and KOS are considered fundamental areas of LIS; however, LIS also includes the disciplines of IR, bibliometrics and user interaction.

[5] Cybernetics is the science that studies the abstract principles of organization in complex systems. It is concerned not so much with what systems consist of, but how they function. Cybernetics focuses on how systems use information, models and control actions to steer towards and maintain their goals, while counteracting various disturbances. Being inherently transdisciplinary, cybernetic reasoning can be applied to

understand, model and design systems of any kind: Physical, technological, biological, ecological, psychological, social, or any combination of those. Second-order cybernetics in particular studies the role of the (human) observer in the construction of models of systems and other observers (Heylighen & Joslyn, 2001)

[6] Peirce preferred to name his brand of semiotics 'semeiotic', due to its reference to the Greek term 'semeion', which means sign, mark or token.

[7] Collateral experience is the concept used by Peirce to address what is prerequisite in order to achieve a common ground for interpretation of signs in communicational interaction. (cf. CP 8.314).

[8] LCSH: Library of Congress Subject Headings

[9] TOTSH: Thesaurus of Occupational Therapy Subject Headings

[10] MESH: Medical Subject Headings

[11] An enumerative classification system is a system that lists all the specific subject classes, as opposed to, for example, faceted systems, in which the specific classes are made by the indexer or searcher by combination of non-compound classes. The DDC, the UDC and the LCC are examples of enumerative systems (although, the DDC and especially the UDC, have some elements of faceted classifications) (Hjørland, 2007a).

[12] The term "thesaurofacet" was coined by Aitchison et al. (Aitchison, Gomersall, & Ireland, 1969) as the combination of a faceted classification and a thesaurus.

[13] A hierarchy in which some vocabulary terms have more than one broader term.

[14] Semantic network http://en.wikipedia.org/wiki/Semantic_network

[15] PMEST is short for Personality, Matter, Energy, Space and Time

[16] XML: Extensible Markup Language (XML) is a simple, very flexible text format derived from SGML (ISO 8879). Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere. (W3F)

[17] RDF: Resource description framework: The Resource Description Framework (RDF) integrates a variety of applications from library

catalogs and world-wide directories to syndication and aggregation of news, software and content to personal collections of music, photos and events using XML as an interchange syntax. The RDF specifications provide a lightweight ontology system to support the exchange of knowledge on the Web. (W3C)

[18] See http://www.britannica.com/EBchecked/topic/162272/dictionary/31962/Kinds-of-dictionaries#

[19] Terminology is a term with several meanings. It may refer to a database or vocabulary of technical terms, it may refer to a particular use of technical terms, and it may refer to the discipline itself. When the meaning intended is to refer to the discipline, Terminology is spelled with capital T.

[20] Aristotle and Plato did not use the term 'concept'. but referred to reality as a relationship between 'essence' or 'primary and secondary substance' (Aristotle) and 'form' or 'ideas' (Plato).

[21] Cluster-analysis is generally associated with statistical methods. However, in Ereshefsky (2001), the definition of cluster analysis includes theories that organize concepts according to a protype, and thus produce fuzzy and graded categories. An important feature with cluster analysis is some sort of similarity measure.

[22] The Vienna Circle was formed by a group of scientists and philosophers in Vienna in the early 1920's, and established what should be known as logical positivism.

[23] "Rudolf Carnap is perhaps the most prominent representative of the logical empiricism or logical positivism school in the philosophy of science and logic". "A student of Frege, Carnap was invited to Vienna, where he became one of the leaders of the Vienna circle". (Sebeok 1994, p. 96)

[24] Bibliometry is a statistical, methodological approach that uses the bibliographical references of papers in academic journals to construe maps of research fields.

[25] Structuralism and post-structuralism is often mentioned successively, and the latter may be regarded as a reaction to the former (Routledge, 2001). However, structuralism is not a unified movement or common

activity of thought. “Structuralism can be seen as the result of applying a synchronic framework of analysis to various regions of cultural and symbolic activity” (Sebeok, 1994). Structuralism relates meaning to structure, what counts as knowledge relates to codes and conventions within a community. This relates to human cultural activity in general, including scientific paradigms.

[26] For detailed introduction to the field of semiotics see: (Chandler, 2002; Deely, 2001; Nöth, 1990; Sebeok, 1994)

[27] Semeiotic is the term eventually preferred by Peirce in his later writings, and is used to here to indicate Peirce’s version of semiotics.

[28] Peirce’s earliest attempt at defining a theory of semeiotic is promoted in his 1867 paper ‘On a new list of categories’ (CP 1.545-6).

[29] Peirce’s account of 10 sign classes is extensively described in his 1903 syllabus (EP 2. 289-99, CP 2.254-264). In Peirce’s later account of semeiotic, Peirce proposed an account of 28 and 66 sign classes. However, they never received the same kind of treatment as the 10 sign classes. The transition from the account of 10 to 28 and 66 sign classes is, however, suggested by (Farias & Queiros, 2003, 2006).

[30] Peirce has several names for his trichotomies, see (Liszka, 1996)

31 The number corresponds to the number of sign class demonstrated by figure 3:2

[32] Peirce classified several interpretants into different trichotomies. The most general consists of the immediate interpretant, the dynamic interpretant and the final interpretant. This classification covers all kinds of semeiosis, however, in relation to human communication, the interpretant is divided into the intentional interpretant, the effective interpretant and the communicational interpretant (or cominterpretant) (Peirce, 1977). Peirce divided this even further, and the effective interpretant is divided into the sympathetic interpretant, the percussive interpretant and the usual interpretant (CP 8.370). The usual interpretant is an effect of general meaning. The concept of usual interpretant is in (Thellefsen, Sørensen, Thellefsen, & Andersen, 2006) related to the concept of significance-effect, which will be discussed further in chapter 7.

[33] Kant divided his universal classes into four categories, where the category of 'relation' is made of 'Inherence and subsistence' (substance and accident), 'Causality and Dependence' (cause and effect) and 'Community' (reciprocity) (Wardy, 1998). Kant's category of relation resembles Peirce's triadic category of thirdness that include a first (legisign), a second (symbol) and a third (argument). A first is determined by inherent qualities, a second by reaction or causality and a third by mediation, synthesis, that which brings a first and a second into relation (Sowa, 1999).

[34] Within the Peirce community, the relation between the different interpretant trichotomies has been discussed. According to (Fitzgerald, 1966), the emotional, the energetic and the logical interpretant may be seen as a further specification of the dynamical interpretant, since they are actual effects on the interpreter. This view is supported by (Short, 1981), who argues that each immediate, dynamical and final interpretant can be subdivided into emotional, energetic and logical interpretants.

[35] In (Thellefsen, 2009), Torkild Thellefsen develops significance-effect further and distinguishes between a normative and a sub-cognitive dimension of significance-effect. The normative significance effect is thus relate to technical terms, and is defined as an effect of intentional meaning communicated by a technical term.

> *The normative significance-effect is an effect of significance or communication of meaning that occurs whenever some mind or minds become exposed to an technical concept. The basic idea of the normative significance-effect is that the more knowledge an interpreter possesses about a given concept, the more information the concept communicates to the interpreter (Thellefsen, 2009, p. 119).*

Furthermore,

> *…the significance-effect is the interpretive effect caused by a meaning intentionally communicated by an utterer to an*

> *interpreter through mediation of a sign. In essence, the meaning communicated is similar to the meaning interpreted. This means that the interpreter must be able to interpret the message the right way, or at least nearly the right way, which is the way intended by the utterer (ibid., p. 124)*

Furthermore, the normative significance-effect depends on the sub-cognitive significance-effect, which is considered the emotional center of any community; it preside the normative significance-effect, and maintains and communicates the emotional effects that are considered desirable by members of the community.